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ABSTRACT

The "alternative road" refers to a practically oriented curriculum, one which is more concerned with being able to do, rather than remembering. The book consists of an edited series of papers which were presented at a conference in England on the rehabilitation of the practical, at which a broad range of interests (academic, professional, educational and political) were represented. The 10 papers included in this document are: (1) National Policy and the Rehabilitation of the Practical: The Context; (2) The Secondary School Science Curriculum and the Alternative Road; (3) State Centralism and the Alternative Road in Higher Technical Education, 1930-1980; (4) Views of the Alternative Road: The Crowther Concept; (5) Technology in Schools; (6) A Comparative View: The Scottish Project "Education for the Industrial Society"; (7) Youth Employment and Unemployment: Implications for Education and Training; (8) What Industry Really Wants: Implications for Education and the Community; (9) A Local Authority Perspective; and (10) The Technical and Vocational Education Initiative. (TW)

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The Alternative Road

THE REHABILITATION OF THE PRACTICAL

Edited by
David Layton

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1

Introduction

Not for the first time, calls are being made for the secondary school curriculum to be given a more practical slant. From the criticisms of the curriculum made in the 'Yellow Book' and in Mr Callaghan's Oxford speech in 1976, to the recently expressed views of Sir Keith Joseph, Secretary of State for Education and Science, there has been a persistent government opinion in favour of more practical studies, especially for the older pupils in secondary schools. Accompanying this has been pressure for increased central control over what the schools teach. Basic to the recommended core curriculum is science, the teaching of which, according to the DES Consultative Paper *Science Education in Schools* (1982), should be characterized by the 'practical and problem-solving approaches needed to tackle real-life technological questions'. This is in sharp contrast to the dominant view on the teaching of science in the 1960s, at the time of the Nuffield Foundation's Science Teaching Projects, when 'purity' and academic concerns prevailed.

It is commonplace to interpret these calls for a more practical orientation to science teaching in terms of an improved contribution by education to industry and employment. Such curriculum changes are claimed as a contribution to the revival of 'the industrial spirit', the cure of 'the British disease' and the resuscitation of a national capability for technical change. They are seen as an attempt to breach that 'cultural *cordon sanitaire*' which, according to Professor Martin Wiener, encircles 'the forces of economic development — technology, industry, commerce' in England, and which hitherto has been reinforced by public attitudes and values transmitted through the system of secondary education.

Clearly, such an account might be criticized for attributing too much influence to education, if on no other grounds; other considerations, including economic, play an important part in a complex story. However, the educational component cannot be ignored. Whereas previous studies of educational policy in relation to technological progress have focussed on the quantity aspects (the number of years of education which children receive, the amount of science in the curriculum, and the supply of qualified students), the emphasis has moved now to the quality of education, its relevance to practical problems, and its contribution to technological abilities and the needs of industry.

There appears to be limited recognition, however, that the general prescription for the arrest of industrial decline by educational measures is a familiar one, being a main plank in the policy of a 'technical education lobby' consisting of associations and pressure groups going back to the National Association for the Promotion of Technical Education (1887) and including, more recently, the Association of Heads of Secondary Technical Schools (1951) and the Association for Technical Education in Schools (1964). An achievement of this 'lobby', in 1959, was the formal acknowledgement of 'an alternative – practical – road' through secondary education by the Central Advisory Council on Education in the *Crowther Report* (Ch 35). Subsequently, other applied science, engineering and industrial interests, including the CBI, have actively supported the cause of 'technology in schools'.

The failure of the secondary technical schools, or – to be more precise – of their curriculum to become an established and distinctive part of secondary education in England and Wales in the post-war years has been the subject of research supported by SSRC funds and undertaken in the University of Leeds under the joint supervision of Professor P.H.J.H. Gosden and Professor D. Layton. A related project, supported by university funds, and under the direction of Professor Layton and Mr. E.W. Jenkins, has examined the activities of bodies such as the Association for Technical Education in Schools, the Engineering Institutions and the CBI, as well as the professional scientific associations, in the period following the establishment of the Nuffield Foundation's Science Teaching Projects, in order to evaluate their role and influence in shaping policy about the school science curriculum. Within this study, questions have been addressed about the notion of school science as a contributory factor to the 'English malaise' and about the currency and validity of the 'alternative road' thesis.[1]

By the autumn of 1982 a point had been reached in the researches when it was clear that there would be considerable benefit in a conference involving some of the principal figures who were active in earlier attempts to make the secondary school curriculum more practical and technological, together with present-day policy makers in the fields of science, technology and education, and a number of scholars with specialized research interests. The aims of this small conference were intended to be:

(i) to enrich our data sources by direct comment from participants who had attempted to implement curricula which were more practically orientated;

(ii) to obtain critical comment and judgements from informed sources on the interpretations and findings from the research projects;

and (iii) to assist us to formulate our report on the researches in a way which would be most helpful to policy and practice.

In the event all of these aims were achieved, and more besides. The subject of the conference was given added point by the Prime Minister's announcement in November 1982 of the launching of the Technical and Vocational

Education Initiative. As a result, analysis of past experience became articulated with the sharp edge of present policy and practice in a quite unanticipated and productive way.

Unquestionably we were fortunate in the participants who generously gave of their time to attend the conference. They provided a reactive mix of academic and professional experience, covering industry, politics, educational administration, policy formation and curriculum reform, as well as more theoretical research perspectives. The papers which were delivered at the conference provoked intense discussion and are reproduced here as a contribution to a debate which still continues. What the papers cannot do is capture the stimulus of exchanges in the working groups and of the informal discussions which ran in parallel with the formal presentations. Something of the spirit of the conference was captured by Christopher Price's later description of its members as 'an impressively conspiratorial lot, united in the need to transform the curriculum (especially the science curriculum) so that it consists far more of doing things than remembering them'.[2]

It is a pleasure to acknowledge a debt of gratitude to the Department of Trade and Industry and to the Nuffield Foundation for financial assistance towards the costs of the conference. I am also indebted to the University of Leeds for financial and other help in connection with the conference and the preparation of this volume.

David Layton
Easter 1984.

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[1] The work is described in: G.J. McCulloch, E.W. Jenkins, D. Layton, *Technological Revolution? The politics of school science and technology in England and Wales since 1945*. Falmer Press. 1985.

[2] *The Times Educational Supplement*, 16 Sept. 1983, p 88.

Part One
THEORETICAL PERSPECTIVES

2

National Policy and the Rehabilitation of the Practical: the Context

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I am sure that the 'practical' in the sense that it is used here cannot be divorced from the 'theoretical'. The philosopher Santayana reminded us that those who disregard the lessons of history are condemned to repeat them. Much more recently Professor Margaret Gowing, in evidence to the Select Committee on Education, Science and Arts when it was investigating the Public Records, made much the same point more specifically when she said, 'I think it is unfortunate that the British Public Service has been so unhistorically minded and has done very little evaluation of past policies, dropped policies and so on.'[1]

Neglect of past experience in policy making has been particularly noticeable in education for a variety of reasons. The Department of Education and Science — like many other UK government departments — does not have the contemporary history of its work written by in-house historians as does now happen in at least some government offices across the Atlantic in an effort to improve the quality of decision-making and to learn from both mistakes and successes. Moreover, education as a field tends to be particularly attractive to those who see it as a means through which their own 'new' ideas might be deployed in order to make society 'more equal' or to 'support' industry or whatever other purpose may be receiving fleeting political and therefore official backing, regardless of past experience. The movement of the most senior officials from ministry to ministry in the manner of the British Civil Service leads to high offices being occupied by persons who may have virtually no personal experience of the administration of the area which they are currently presiding over. Without some attention to the recent historical background — the collective memory of educational government — adequate evaluation of policy becomes impossible and avoidable blunders will be committed. Policy-makers will waste time and resources by tumbling into pitfalls with which they ought to be familiar and will spend their time trying to re-invent the wheel. For these reasons this first paper seeks to set the context by discussing some earlier policy forays in technical and vocational education.

It is not possible here to explore the question of the extent to which there may be a direct relationship between technical education and industrial prosperity and development. Advocates of various forms of technical education have almost without exception assumed that there was such a connection. This assumption was certainly present after the Great Exhibition of 1851 when the Department of Science and Art was set up within the Board of Trade. It was developed out of the existing Department of Practical Art at a time when it was far from accepted that the provision of education should be a public responsibility. Certainly those who took this step could hardly have imagined that they were setting up an office which would develop into the secondary education department of the Board of Education half a century later.

It is worth recalling here how the Department of Science and Art operated from 1859 after a number of comparatively ineffectual efforts. Each year a Calendar was published which contained the syllabuses of authorized courses for which grant would be paid to teachers or schools in proportion to the success of their pupils in the annual examination. The system of payment by results was first applied here and later copied in the Revised Code for elementary schools in 1862. This method of working proved to be very successful in that the number of students and courses grew considerably. Many endowed grammar schools, for instance, adopted Science and Art Department courses in mathematics, the sciences and even modern languages, entered their pupils for the Department's examinations and by this means sought to increase their inadequate income. The extent of the penetration and growth of the Department's activity may be judged by comparing the £56,000 it disbursed in 1854 with the £770,000 of grants which it paid in 1896.

The belief that the country needed far more technical education led to the setting up of the Royal Commission on Technical Instruction in 1881 'to inquire into the instruction of the industrial classes of certain foreign countries in technical and other subjects, for the purpose of comparison with that of corresponding classes in this country'. Its members were strong supporters of the cause of technical education and included such famous names as Samuelson, Magnus, Roscoe and Swire Smith. The voluminous survey they produced of many countries led to the recommendations that drawing, metalwork and woodwork should be encouraged in elementary schools; that science classes be made more practical; that more science be introduced into teacher training courses and, above all, that the system of elementary and secondary schools should be vastly improved since they had come to the conclusion that a good general education was the necessary foundation for technical instruction.[2] The foundation in 1887 of the National Association for the Promotion of Technical Education was one consequence of the pressures stimulated by the Commission.

The last years of the nineteenth century saw the impetus having its effects in various directions. A year after county councils were established in 1888, they were given powers to give rate aid to technical education through technical instruction committees.[3] In 1890 the supporters of technical education succeeded in directing some part of the funds available under the Local Taxation (Customs and Excise) Act, 1890, to county councils so that they might use it 'for the purposes of Technical (including Agricultural and Commercial) Education'.[4] In the first year authorities in England and Wales received a total of £743,000 from this source although they were not compelled to spend it in this way. This great thrust inevitably led to an increase in provision for secondary schooling as technical instruction committees learned by experience that students who lacked an adequate general school education were unable to get much benefit from strictly technical and vocational courses. Thus some counties created sophisticated systems for supporting secondary and technical education and for aiding the most successful scholars further with three-year undergraduate awards tenable at nearby university colleges. Foremost among these was the West Riding of Yorkshire, where Arthur Acland and Swire Smith were influential, and London, where Sidney Webb did much to build up the work of the LCC Technical Instruction Board.

The legislation of 1902[5] which really established the present framework of local education authorities made no special provision for vocational or technical education. All education that was not elementary was regarded as higher. Thus secondary (grammar) and trade schools along with technical colleges were so classified. From 1905 Statutory Regulations permitted financial support for day technical classes which offered courses adapted to the vocational requirements of students even although these might not be of a post-secondary standard. By 1913 the Regulations came to include a specific set of 'Regulations for Junior Technical Schools in England and Wales'. These schools were defined as 'day schools, organized as part of the higher education system and providing a continued full-time education under school conditions for pupils from elementary schools in preparation either for artisan or other industrial employment or for domestic employment' — in other words, vocational secondary schooling. These schools were certainly never intended to provide courses leading to university entrance or to the professions. Under the Regulations no pupil could be admitted without a Certificate from the parent that the child would enter employment for which the school offered a preparation. Practical work was required in all suitable subjects and the staff must include a preparation with practical trade experience of the occupations for which the individual school prepared. An advisory committee with representatives of employers and employees was to be appointed whenever possible.

By the 1930s there were four broad types of school within the classification of junior technical, viz.

- (i) trade schools which provided training recognized by the trade as equivalent to that given in the corresponding period of normal apprenticeship;
- (ii) pre-apprenticeship schools for pupils from 13 to 16 who would enter a particular industry such as engineering or building but had not at 13 decided which trade they would enter within that industry;
- (iii) schools akin to those in the previous category designed to give girls general preparation for 'home management';
- (iv) junior commercial schools which prepared both boys and girls for commercial life as book-keepers, telephone operators, shorthand typists and so on.

The total number of schools in these broad categories in 1937 was 267, with 21,511 boys and 8,250 girls in attendance. The great majority were housed in technical colleges and most were small — more than half had fewer than 100 pupils. Their smallness was often due to the desire to limit the intake to a figure which it was thought that the appropriate local industry could absorb. Even so there was a considerable increase in the total number of pupils between the wars; in 1925 there were 11,954 but twelve years later there were 29,761.[6]

The demand for technical schools was strong but the willingness of the government and of the local authorities to meet it was not particularly obvious. The struggles of the Board of Education with the Treasury led the President to submit a memorandum to the Cabinet in March 1939 duly classified as 'secret'. He said that he was seriously concerned about the inadequacy of facilities for technical education, from both the industrial and social points of view. The extent of the provision and the conditions under which it was given were 'most unsatisfactory'; not only were facilities inadequate but they were 'frequently of poor quality, out-of-date and, in terms of value received, expensive to administer'. The President explained to his colleagues that while the provision of technical education was entrusted to counties and county boroughs there was no statutory obligation on them to make provision and the Board could not insist on deficiencies, 'however glaring', being made good. 'Taking the country as a whole, the result is deplorable.' There was a particular need for technical schools to prepare boys for entry at 16 into engineering, building and the construction trades. There was a general absence of adequate cooperation between industry and the technical schools and that was said not to be surprising seeing that such schools were too often housed in mean, scattered and ill-equipped buildings. The only means of overcoming these obstacles was to make the provision of secondary schools sufficiently comprehensive and attractive not only to induce the attendance of the young but also 'to capture the interest and cooperation of the employer'. The case was reinforced by comparing the position here with that abroad, particularly in Germany. An appendix surveyed the position of technical education as a whole in individual local authorities and typical were the comments on Croydon — 'there is apathy here, with the excuse of financial stringency, which in so prosperous a town is very unconvincing' — or Leeds — 'the provision is inadequate and unworthy'.[7]

The Report of the Spens Committee in 1938 had recommended that junior technical schools should be treated as the equivalent of secondary grammar schools and should be known as technical high schools. When the war began in September 1939 there had been no positive response to this from the Board of Education, where a number of influential officials were opposed to the recommendation. It also found little favour among local education officers. Thus the war came just when the future of technical and vocational education was posing a number of questions which would have required answers. The immediate effect of the war was to postpone the resolution of these issues; the longer-term effect was to bring about a reconsideration of the whole organization of the pattern of schooling in which the particular matter of technical and vocational schooling was absorbed.

At the outbreak of war, junior technical schools in the large cities were evacuated along with other schools and colleges. But once the initial impact of September 1939 was overcome, the enormous improvement in the economy stimulated by the conditions of wartime and heavy procurement expenditure by the state led to a strong demand from employers in the engineering and construction industries for the products of the technical schools. This demand ensured that in spite of the difficulties of wartime, these vocational schools flourished. But even while this type of schooling enjoyed a stronger demand and greater popularity, the very nature of the discussions, consultations and planning for the future weakened its long-term prospects.

The central issue for the civil servants who set about planning 'the New Jerusalem' was how to provide secondary school education for all rather than for about ten to fifteen per cent of each age group which went to the pre-war grammar schools. The major obstacle in the way of achieving this was the religious issue, and R. A. Butler, the President of the Board, spent a great deal of his time from 1941 to 1944 in discussions with the different churches trying to resolve this. Indeed, in a note reflecting on the reorganization problems that confronted him in 1942, Butler wrote that the best thing would be to accomplish the work which 'best chimes with the hour in which we live. I am clear that we are beginning to get to grips with the Religious Question, and, if that were cleared up, a great task would be done'.[8]

The form which secondary education would take was decided by the senior officials of the Board in discussions in the winter of 1940-41. Some such as Cleary, head of E Branch, sought to go directly for a common secondary school for all children over 11 while others, especially Williams at the head of S Branch, strongly opposed any change which would imperil the grammar school. The issue was eventually resolved by the permanent secretary, Holmes, who argued that the amount of building required by a common school solution would be so extensive that 'the New Jerusalem' would never be achieved within a reasonable period of time after the war. In order to move with any speed at all, existing school buildings would have to be used and that meant separate grammar, modern and technical schools. In terms of a tripartite structure, Wallis, head of T Branch, argued that a break at 13 was desirable, indeed essential. At one stage in the discussions he urged a two-year period of preparation for secondary schooling from 11 to 13 with a sorting-out process at the end. This was opposed by both secondary and elementary branch colleagues. Williams argued from the S Branch standpoint that a five-year course was essential for the first school examination taken at 16 and his view was sustained. Wallis and T Branch generally believed that 11 was too young for recruitment to vocational schools and felt unable to propose that technical schools generally should recruit before 13. Thus they would find in the new arrangements — as in the old — that their pupils would be drawn from among those who had failed to get into the grammar schools two years earlier.[9]

In the course of the exchanges between the permanent assistant secretaries, Wallis set out an interesting defence of 'vocational education'. He pointed out that in 1938, of 570,000 pupils leaving elementary schools, 450,000 went direct to employment, mainly to unskilled and semi-skilled occupations. This was inevitable and there was no case for giving elementary school children any specific training for employment, 'though cultivation of handiness and adaptability is naturally desirable'. In the same year, 80,000 left secondary (grammar) schools, of whom 47,000 went directly to employment. Of those, 8,500 went to government or local government services, 5,000 to nursing and kindred occupations, 20,000 to commerce, banking and insurance (including 14,000 clerks) and 4,000 to the distributive trades while 6,000 were classified under 'skilled trades' but only 700 went into industry. In other words the secondary school output was directed to the professions in a wide sense and to commerce. Of 13,000 leaving junior technical schools, about a half went into engineering, building and construction, a quarter (mainly girls) into commerce and the remainder in small numbers to other trades and the merchant marine. Wallis believed that the picture this showed indicated that vital industrial needs required more technical and vocational schooling. The break at 13 was desirable since the greater emphasis placed on the objectives of the schools in relation to employment implied a more reasoned choice of the type of schooling by and for the individual pupil than could be achieved earlier. He concluded his note to his colleagues by suggesting that these points were so vital in regard to the contribution which the schools might make to the country's prosperity after the war 'that we might approach the subject again on these lines'.[10]

The outcome of these memoranda and discussions was that early in 1941 the permanent assistant secretaries agreed that while there should be selection at 11 between grammar and modern schools, the transfer at 13 to technical schools could be from both grammar and modern schools on the basis of the educational qualities revealed by the pupils concerned. The very organizational structure therefore would continue to ensure that technical or vocational schools would really only draw from what Wallis described as 'this second-class category of recruits'.[11] Although he continued to raise the issue, the matter had effectively been decided and the papers give the impression that T Branch was left to lick its wounds. A month or so later, Wallis concluded a note to R. S. Wood, Deputy Secretary, with the sad comment that he would have been prepared to accept general recruitment from the modern schools at the age of 13 so far as T Branch was concerned 'so long as we were in the same position in getting recruits as S but this idea was not generally acceptable'.[12]

It may be correct to suggest that the weakness of T Branch and its head in dealing with such strong personalities as G.G. Williams of S Branch and William Cleary of E Branch was an important factor in the failure of the vocationally orientated schools — or vocationally orientated curricula — to flourish in the school system under the 1944 Act. But it must also be asked what did industry, commerce or the ministries which were supposed to attend to their interests do about all this? The first detailed indication of what was happening in the Board was the issuing of the Green Book in 1941. This was the final version of the draft proposals for educational reform from the permanent assistant secretaries. It was never published but circulated to LEAs, churches and within the government machine under 'strictly confidential' cover. Among the confidential inter-departmental exchanges, the most striking reaction was that of the permanent secretary to the Treasury, Horace Wilson, a former permanent secretary to the Ministry of Labour. He set out his comments in a note to Maurice Holmes, permanent secretary to the Board. He pointed out that he was not commenting from a Treasury point of view. In the Green Book there was only one reference to industry and commerce. He said that when he had taken charge at the Ministry of Labour he had been struck by the aloofness of the Board of Education which led leaders of industry to condemn a good deal of the education system. He could not understand why the Board of Education did not make any use of the Ministry of Labour to get industry's support for its work. While at that Ministry Wilson recalled that he had wanted to bring industrialists and educationalists closer together. He thought it indefensible to maintain the divorce between education and industry in an industrialized country. The Green Book was disappointing because it made no effort to enlist the support or sympathy of industry. Even the section on choice of employment made no mention of employers' associations, trade unions or the Ministry of Labour.

Holmes sent a detailed reply to this formidable indictment. He denied that the Board had been slow in meeting the needs of industry and commerce. He agreed that at the end of the First World War there had been acute differences between Education and Labour over choice of employment matters, but later they had cooperated in settling these issues. He admitted that in the early 1920s the Board had been somewhat aloof in its attitude to industry and commerce, but from about 1925 a series of committees had been set up by Eustace Percy [then President] to deal with relations with both. The findings of these had not been used to set up any permanent formal relationships with industry because of the refusal of the leader of the Engineering Employers Federation to commend the Report on Education for the Engineering Industry to his members. More recently the Board had been given the impression by Forbes Watson (of the FBI) that industrialists were not prepared to take technical education seriously until the standards of technical school buildings and equipment were much improved, but the outbreak of war had prevented this from being done. So far as the Green Book was concerned, unless elementary and secondary schools had been given a more definitely vocational function and character than the Board felt justified, it would have been difficult to extend references to industry and commerce. He closed by assuring Wilson that T Branch was alive to the need to work closely with the Ministry of Labour.[13]

As a result of the inter-departmental pressure which built up in 1941, there were informal discussions among a small group of officials. The group found that while it was easy to talk about 'Education for Industry', in practice neither industry nor commerce existed as corporate entities with which the education service could establish relations. It concluded that while some basic principles could, no doubt, be agreed for the future development of vocational training or technical education, it would be necessary to devise actual schemes industry by industry and occupation by occupation.[14] The group made little further progress and five months later Butler sent a memorandum to its convener, R.S. Wood, in which he commented that 'We do not seem to have progressed in the matter of contacts with Industry, and recently the Engineering employers called off their own request for training. How do I set about making Industry play?'[15]

Further on in his memorandum — which was lengthy and dealt with a number of issues — Butler commented, 'Politics is said to be "L'Art du possible". The question is — what is possible?' It was becoming clear that the President considered that he was unlikely to achieve a great deal in this direction.

The failure of the Board of Education to give a higher priority to technical education generally — post-school also — produced some protests from educational and industrial quarters when the White Paper, *Educational Reconstruction*, outlining all the proposals for reconstruction, was published in 1943. Technical education was not mentioned in the plan for the first four years and the financial table forecasting expenditure showed no appreciable increase in expenditure on it. Interestingly enough, there was one protest from an internal group, namely HMIs concerned with engineering education, who submitted a memorandum on the absence of adequate financial provision for technical education in which they asked for the matter of priorities to be re-examined with urgency since they had been obliged to infer that it had been 'deemed expedient on political grounds only' to give priority both in time and in relative expenditure to other branches of education.[16] Confronted with external and internal protests, there was a tendency among those responsible in the Board to put the blame on the Treasury. Certainly the Treasury had not agreed to additional expenditure on technical education but then it had never been pressed to do so. The decision not to give this priority had been taken in the Board, where there was a feeling that resources would only be available for so much and that developments in technical education were among those to which priority could not be given if there were to be a realistic hope of achieving such aims as the reform of the dual system and secondary education for all.

At the end of September, 1943, Wallis suggested to the Deputy Secretary that the Treasury's agreement be sought to increasing the figures for technical education in the financial appendix so that the President might make a statement to that effect and thus meet the points the critics were raising. The Deputy Secretary advised Butler that 'the trouble into which we have got ourselves' was indeed due to a desire to keep expenditures as modest as possible in the four years following the end of the war as well as to 'confusion in our own minds' over the figures in the financial appendix. He added a draft letter for Butler to send Sir John Anderson, Chancellor of the Exchequer, seeking agreement to a 'possible' Parliamentary answer which would simply say that everything that could be done to meet the demands of industry and commerce would be done as soon as hostilities ceased. Anderson had no objection to this course and a Parliamentary question was accordingly arranged.[17]

Since the preparations for the Butler Act of 1944 and the reconstruction policies and priorities developed at the time have had such a powerful influence on the shape of the education system during the last four decades, I have thought it essential to examine at some length attitudes then current in the Board of Education to the future of technical and vocational schooling. It is not possible to examine in comparable detail here the actual story of the demise of the secondary technical school and the decline of technical and vocational courses in comprehensive schools.

In the years immediately following the ending of hostilities, the need to repair and replace bombed homes was paramount and for some years there was an enormous strain on the building industry as well as an acute shortage of supplies. At this time the Ministry was emphasizing that the nation's new secondary policy rested on two principles — all schools were to be equal yet they were to be of three types. Perhaps it was in *The New Secondary Education* (1947) that the Ministry spelled out its policy most fully. In the Foreword, Ellen Wilkinson explained that no child must be forced into 'grammar education' because it was considered socially desirable by parents. There must be 'parity of esteem' between different types of schools. This meant there would need to be parity of social esteem for the avocations to which pupils went from the schools. Fortunately the British people were learning by the hard way just how dependent a civilized community was on its manual and technical workers. Incomes were being adjusted accordingly; 'clearly this is bringing us to a saner way of life'. The change in public attitudes was 'revolutionary, and it has taken two world wars to teach the lesson'. By this time the Ministry had concluded that the age of admission to technical schools would have to be 11 if they were really to take their place alongside grammar and modern schools. *The New Secondary Education* explained that secondary technical courses would be longer than those in the old junior technical schools, and that they would be accommodated separately — not in technical college premises as before the war. The provision of places in an area was no longer to depend primarily on the likely number of posts for leavers in local industry as in the past, 'it must be geared to the number of boys and girls who show promise of profiting from this particular kind of education'. During the first two or three years pupils would follow general courses and since the same importance must be given to English, mathematics, science, history, geography, religious instruction, physical education, art and music as in other secondary schools, it would be necessary to allow less time for specifically technical subjects in the years up to 16 than was normal in junior technical schools.[18]

If these were the aims, it was evident that virtually no progress had been made towards their achievement by 1947. The booklet admitted that secondary technical schools were in fact little altered save in name from the junior technical schools of pre-1944, either in the matter of premises or of organization. Eighty-five per cent were organized as parts of senior technical institutions and housed in their buildings. The courses began at 13 and did not go beyond 16. The post-war aim of the Ministry was, therefore, to develop out of these vocational schools secondary schools which were not so much vocational but which offered general secondary education with a technical bent. It was admitted that selection for such schools would be difficult. 'To assume that the "top layer" in intelligence will always go to the grammar school would be contrary to the 1944 Act. It should be possible for the brightest and ablest pupils to go to whichever type of secondary school will best accord with their interests, their special aptitudes and the kinds of career they have in view.' The 'notorious difficulty at present' of recognizing technical aptitudes at 11 would make a great deal of later transfer to and from technical schools necessary 'for a time at least'.[19]

In retrospect, the new prescription for technical schooling which was no longer to be strongly vocational nor necessarily related to the opportunities likely to be available in local industries appears unlikely to have ever stood much chance of being effective. Eventually the coming of the comprehensive school ended the separate existence of technical schools, but even before that they never became a serious third element in the national secondary provision, which was bipartite rather than tripartite in most places. Where some individual secondary technical schools were successful in the 1950s their success often owed much to local circumstances and personalities. Where they existed it was too frequently the case that the first choice for the parent would be to send his child to the grammar school; if that were impossible the technical school seemed to offer a second-class journey as against third-class in the modern school. If the schools were not to be markedly vocational and if their recruitment was to be linked to the discernment of certain undefined 'special aptitudes', it was not surprising that no attempt was made to provide these schools in many areas.

Moreover, the prevailing attitude among educationists and among HMIs in the decades immediately following 1944 was to emphasize the importance of general education to the age of 15 or 16. The post-war reorganization within both the Ministry and the Inspectorate also served to undermine the position of technical and vocational schools. The ending of the branch system of organizing the inspectorate meant that technical schools were no longer the responsibility of a group of technical education HMIs, but were part of the general secondary arrangement. The Ministry itself was reorganized so that E and S branches became schools branch and took over responsibility for all secondary schools. The former T branch concerned itself with post-school education. Wallis, as head of T branch, might not have pressed the cause of secondary technical and vocational schooling very successfully, but in future it would quite simply not be the responsibility of the successor further education branches to look after this form of education at school level; in that sense these schools lost their special advocate within the Ministry with all that that implied.

One post-war development which was designed to help the advancement of technical schooling was the establishment of a 'ninth examining body' as it was called at the time, or Associated Examining Board for the General Certificate of Education as it came to call itself. With the new subject rather than group basis for the GCE when it came to replace the School and Higher School Certificate examinations, it was thought likely that technical students who had taken the examinations of such regional bodies as the Northern Counties TEC or the Union of Lancashire and Cheshire Institutes would turn to taking a few GCE subjects instead. The syllabuses of the existing university examining boards were believed to be unsuitable for such students since they were less practically orientated, less 'applied' and more theoretical in their approach than examinations set by City and Guilds and the regional bodies. Negotiations between these organizations and the Secondary School Examinations Council were protracted. At the end of 1950 the sponsoring regional bodies, whose chief spokesman was really Cyril Lloyd of the City and Guilds Institute, produced a 'second memorandum' in which they set out their proposals and sought to counter criticisms. The existing situation presented an opportunity for fostering education in secondary technical and secondary modern schools and the sponsoring bodies believed their experience could be useful through the agency of a new GCE examining body for such schools. The existing GCE examinations were influenced by the entrance requirements of universities and professional bodies and by the traditional form of grammar school education. While maintaining standards, the syllabuses needed to be reconstructed for the young people in the new secondary schools who would proceed to other vocations.

The memorandum listed a number of additional subjects which the new board would offer. This included principles of accounts, theory and practice of commerce, surveying, engineering workshop technology, woodworking technology, cookery, navigation and aeronautics. Existing subject syllabuses would be framed more widely; for instance, while the content of the mathematics syllabus would have the same intrinsic content as those of the existing bodies, it would also permit the teaching programmes in classes to relate the principles of the subject to commerce, engineering, building and so forth.[20] The local authority associations gave support to the creation of the new body since they were unhappy at the apparent influence of university examining bodies in their grammar schools and this at least seemed to prevent its extension to the new secondary schools. The Minister of Education finally gave his approval to the creation of the ninth examining body in 1953.

The impact of Circular 10/65 and the subsequent movement towards comprehensive forms of secondary school organization is too large an issue to be treated in this paper. It led to most of the remaining secondary technical schools being incorporated into some sort of comprehensive framework and this really served to make the survival of any distinctive technical or vocational forms of secondary education virtually impossible. And so it was that in 1982 the Technical and Vocational Education Initiative did not evolve out of existing developments in the schools, but through an external source, the Department of Employment's Manpower Services Commission.

In this case the central government had decided that it wished to inject a strong dose of technical and vocational schooling into the curriculum for boys and girls of 14 to 18. In the terms of the 1944 Act the obvious department to have taken the initiative and through which the government would have acted was the Department of Education and Science. Developments in the local government area during the last twenty years prevented this. The adoption of forms of general grant from the central government since 1958 and the abolition of specific education grant had made it impossible for the DES to take this sort of initiative. While the DES might advise how much should go into the general grant to meet educational needs, the grant is the constitutional responsibility of the Department of the Environment in its role as the local government ministry. If the cost of the TVEI had been added to the general grant it may be said with complete confidence that it would not have been spent in the way intended. Local authorities have become used to a situation in which they decide at local level how much each service should receive for which they have responsibility. Their associations claim that the local council alone is in a position to make a fair appraisal of the needs of the various services for its area and the associations guard fiercely this recently acquired privilege. Thus it was that the offer of central government funding for this specific purpose had to be made through the Manpower Services Commission. As an agent of the Department of Employment it could enter into a direct funding relationship with individual local education authorities which was forbidden to the DES. In an effort to overcome this blockage future legislation is now proposed which would permit the DES to withhold a small fraction of the education component of the general support grant and use it to pay for any educational initiatives which the government may wish to encourage LEAs to undertake.

In a consideration of the context for the 'rehabilitation of the practical' it should also be borne in mind that the position of industry and commerce in the local government of education itself may have been weakened by the reforms of the early 1970s. The attempt supported by the Department of the Environment to abolish the statutory requirement that a council with education powers should only exercise those powers through an education committee was successfully opposed in Cabinet by the Secretary of State for Education and Science. The county and metropolitan district councils as they emerged from the legislation of 1972 were required to have education committees with outside, i.e. non-councillor members. These were to be drawn in part 'from persons with knowledge and experience of industry and commerce, agriculture and the universities'. The intention clearly was that there should be an input into local decision making from those who might have some interest in technical or vocational education. Yet the reformed internal structure of the councils themselves, the stress on the 'corporate' nature of decision taking, the establishment of policy and resources committees which stand between specialist committees such as education and the council itself, to determine policy and control the flow of funds, mean that education committees themselves tend to occupy a less influential role than before the reforms. The effect of these changes in many councils seems to have been to make the caucus meeting of the governing political group the place in which the more important education decisions are taken while the education committee meetings as such have lost in importance so that representation on them for an outside interest often has less significance than was once the case.

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The Secondary School Science Curriculum and the Alternative Road

David Layton

INTRODUCTION

Attempts to make the school curriculum more practical, more related to productive industry and more relevant to the perceived needs of pupils, parents and employers are as old as state-supported schooling.

In 1845 an extremely wet summer brought about the ruin of the English wheat crop, followed by the blight of the Irish and Scottish potato harvests. One consequence of this economic disaster was a sustained attempt to inject agricultural science into the curriculum of elementary schools. There is a well documented story which testifies to the fact that then, as more recently in many countries in the developing world, agriculture never acquired a secure position of high status in the school curriculum.[1]

It was no coincidence also that at the same time (1845) in England the Royal College of Chemistry was founded as a private venture in London, intended as an applied research institute to service the needs of agriculture. In the event, and ironically, through the influence of its first director, the German chemist Hofmann, the College — a precursor to Imperial College — became a prime channel for the introduction of the ideal of '*pure* science' into England.

The point of this little vignette is that it illustrates well the fate of most previous attempts to construct an alternative, more practical educational road. Failure — in relation to both teaching and research — has been the characteristic outcome. However, one should not be put off by 'failure'. Sir Karl Popper has reminded us that we learn more from our failures than from our successes,[2] provided we examine them aright. Hopefully, we can turn them to good effect. In consequence, much of what I will be concerned with in what follows might be categorized under the heading of 'Knowing the enemy'. If we are going to aim for the construction of an 'alternative road', it is as well to be fully aware of what we are taking on. The tendency in the past has been to underestimate the magnitude of the task in hand.

CONTEXTS OF CURRICULUM

Although I shall limit what I say to just one area of the school curriculum — that concerned with science — there is a general point about the curriculum that is worth bearing in mind.

It is helpful to think of curriculum as existing within a series of inter-related, concentric contexts corresponding to different levels of decision-making. The number of these varies from one contextual analyst to another, but a simple binary division into national and instruction/classroom contexts will suffice for present purposes although clearly the reality is more complex.[3]

One of the major lessons from the past quarter of a century of attempted curriculum reform in many countries throughout the world has been the recognition of the importance of macro-level influences from the national, cultural context on the outcome of events at classroom level. Thus, the international transfer of science curriculum materials from the country of origin to another, different culture has demonstrated time and time again that complex factors in the national political, economic, religious, linguistic and social contexts can radically transform outcomes.[4]

In saying this, I am in no sense discounting the importance of considerations at the classroom level. But the common sense view, which informed much curriculum development in the 1950s and 1960s, that all we had to do was get things right in the classroom, i.e. provide suitable texts, appropriate apparatus, in-service courses for teachers, new-style examinations — has been demonstrated as not so much wrong as grossly inadequate. Curriculum change is a profoundly more complex matter than we had anticipated. In this connection, you will recall the observation attributed to Jerrold Zaccharius, a distinguished physicist from MIT and one of the leaders of the American science curriculum reform movement, that it was easier to put a man on the moon than change the high school science curriculum.

What I aim to do, then, is identify a number of issues which seem to be important in relation to any attempt to 'rehabilitate the practical' and to establish an alternative to the prevailing academic school science curriculum. I will start first at the national, macro-level and then turn to classroom issues. My list is not intended to be comprehensive and exhaustive, though clearly I have selected issues which I believe to be significant. Having commented on the issues, I will then try to draw the threads together, in order to speculate briefly on whether the context has changed sufficiently to permit a degree of hope about the prospect of establishing 'an alternative road'.

SCHOOL SCIENCE AND INDUSTRY

An instructive point of departure is the nature of the interface between the school science curriculum and industry. Putting the matter another way, why has school science, viewed historically, been so 'pure' and largely uncontaminated by industrial concerns? What are the contextual origins of 'purity' and why, over an extended period of time, have they proved more powerful than influences for 'utility' and 'application'?

There are a number of strands in any attempt to answer these questions.

(i) The ideology of pure science

In a 'free-trade', *laissez-faire* context, such as existed in the early nineteenth century, only those branches of science would be supported by the public which had obvious utility. If we consider a specific example, the case of botany, it would be economic botany that mainly flourished in such a context. Botanical knowledge would be valued only to the extent that it had pharmaceutical, horticultural, agricultural, and constructional applications. However, to allow science to be evaluated in terms of considerations external to it could seriously distort the development of a science. Physiological botany, for example, and the study of the internal chemical mechanisms of plants would not be encouraged despite the fact that relevant techniques were available and 'good questions' were waiting to be answered.[5]

So there arose a resentment on the part of scientists of this dependence of science on values extraneous to it. Science, they argued, should be studied for its own sake and the internal dictates of the subject, as perceived by investigators, should be the prime determinant of the direction of future inquiry.

This 'ideology of pure science' was well burnished in the second half of the nineteenth century and probably no single event in England more encouraged the rhetoric of purity than the Great Exhibition of 1851. This industrial trade fair was a major financial success, although it provided some disturbing evidence of the extent of growth of foreign competition. A prime candidate for the Exhibition surplus of some £186,000 was the creation of a metropolitan technological university devoted to applied science.

This aroused strong opposition from scientists of the day. Thus, we have Lyon Playfair, in a lecture on the results of the Exhibition, arguing forcefully that it was 'the cultivators of *abstract* science, the searchers after truth for *truth's own sake*', who were 'the horses of the chariot of industry'.[6]

Playfair's refrain was taken up by many others. George Gore, in a work on *The Scientific Basic of National Progress* (1882) gave many examples of his thesis that scientific discovery was 'most valuable in its practical results when it is pursued from a love of truth as the ruling motive'. For Gore, any attempt to make it more directly and quickly remunerative by trying to direct it to immediately practical ends simply decreased the importance of its results. In discovery, a man had to follow where Nature led.[7]

The message was convincingly supported to such good effect that by the opening of the twentieth century a President of the Royal Society could assert that 'the supreme value of research in *pure* science for the success and progress of the national industries of the country could no longer be regarded as a question open to debate'.[8]

The social contract which professional science negotiated with society in this period — in effect, 'give us the funds, don't tell us what we must spend them on, but be assured, in the fullness of time, good things will come your way' — has, of course, been breached subsequently in all sorts of ways. Nevertheless, as Thomas Kuhn has pointed out, 'The insulation of the scientific community from society permits the individual scientist to concentrate his attention upon problems he has good reason to believe he will be able to solve. Unlike the engineer . . . the scientist need not choose problems because they urgently need solution'.[9] The sovereign goal is the advancement of scientific knowledge.

(ii) *Purity infects the classroom*

This pure science ideal, constructed in a research context, became embodied also in teaching contexts, both in schools and universities, in the late nineteenth century. The reasons for this are partly to do with the reproduction of scientists according to this particular model, and partly to do with the concept of a liberal education which prevailed at that time. The educative qualities of science as a school subject were thought to reside in its ability to discipline the mind, rather than in its utility and practical problem solving potential. Science had to be justified in the curriculum in the same terms as classics and mathematics were justified, if it hoped to make any inroads.

In this way, by the time that a national system of secondary education was being developed belatedly in the early twentieth century, the science curriculum had taken a particular form and the tradition of 'purity' had been institutionalized in texts, laboratory design, apparatus, examinations, recommended pedagogies such as heurism, and the education and training of teachers. All of this was supported by a powerful disposition amongst the subject guardians for disconnection from societal values, especially utility and industrial applications.[10]

TECHNICAL EDUCATION ANGLICIZED

I want to turn now to a second 'macro-level' issue, the way in which we operationalized the concept of technical education, because there was an 'alternative road' being constructed at the same time as school science was being purified.

Again, immediately following the Great Exhibition, and in recognition of the need to revitalise British industry, a new government Department of Science and Art (what today we might call Science and Design) was established, originally under the Board of Trade and offering education for artisans. After a shaky start, its courses prospered, attracting just under 200,000 science students by the end of the century.[11]

This 'technical education initiative', particularly in the 1890s when it was supported by considerable sums of so-called 'whiskey money', necessitated a clear definition of the activities that it was appropriate to include under the heading of 'technical education'. It was around this time that T. H. Huxley claimed it was beyond the wit of men to frame a satisfactory legal definition of technical education. Satisfactory or not, a definition was incorporated in the Technical Instruction Act of 1889, technical education being limited to 'instruction in the *principles* of science and art applicable to industry' and *not* to include 'teaching *the practice* of any trade or industry or employment'.[12]

The reasons for this restricted definition, which contrasted with some continental versions of technical education, were several. One important consideration, related to the *laissez-faire* economic doctrines prevailing, was that state-aided instruction in the *practice* of a particular industry could be seen as equivalent to a direct subsidy. This was an unacceptable measure in so far as it departed from the principle of 'a fair field and no favours' supported by many business men of the time. As an official of the Department of Science and Art expressed it, 'a state pottery school and Messrs. Minton cannot exist side by side'.

A further consideration was, no doubt, fear about loss of trade secrets in a competitive industrial situation, if too much of the practice of an industry or trade was exposed to public scrutiny. Yet again, technical education was perhaps too readily equated with vocational education and the associated risk of restriction of occupational opportunity. An emphasis on *principles* was a means of retaining some freedom in this matter, whereas the inclusion of *practice* would be specific and limiting. A final point was that the definition consorted well with the requirements of professional science for an emphasis on 'purity' and 'abstraction', many of the leading scientists of the day being examiners in their subjects in the Science and Art Department schemes.

The result of all this was that the alternative technical education road constructed in the late nineteenth century was in practice not greatly different from the liberal education road so far as science education was concerned. Scrutiny of the syllabuses and examination papers of courses approved by the Science and Art Department reveals few differences from counterparts in pure science. The emphasis was on 'theory' and 'principles', the application of these to industry being left as a responsibility for each branch of industry to pick up subsequently, if it so wished.

Although some shifts in this division of labour between the educational and industrial systems took place later, the settlement negotiated in the late nineteenth century remained characteristic of much that followed in the twentieth century. There is, incidentally, little evidence that investment in technical education, so defined, had any direct beneficial results on industrial performance. Rather, when for whatever non-educational reasons an industry prospered, it was often the case that investment in technical education followed.

HEAD AND HAND

A third issue which demands examination in any consideration of the alternative road is the historic split between head work and hand work which has characterized education since the time of Plato.

The origins of this have been well analysed by others. I think, for example, of John Dancy's excellent presidential address to Section L of the British Association for the Advancement of Science, as far back as 1965,[13] delivered at a time when he was actively involved in the introduction of technological activities into his own school, Marlborough College.

Dancy, himself a classicist, acknowledged that Plato was 'a social and intellectual snob' rolled into one, a combination which he describes as irresistible to the English. In short, Plato's intellectual theory matched and reinforced our traditional social practice, philosopher kings at the top of a caste system, with 'mere artisans' at the bottom. I won't dwell on this point because its manifestations are familiar and have been given specific point in the Finniston Report (1980), especially in the sections dealing with engineering in the British culture.[14] In passing, however, it is worth recalling Dancy's anecdote that practical Platonism infected even engineers, the toast-list of the Smeatonian Society including one to 'The memory of our late worthy brothers, Mr Smeaton, Mr Mylne, Watt and Mr Rennie'. To this the guests were supposed to respond, 'Mister Watt', a polite correction to the implication that higher status accrued to civil engineers compared with 'base mechanicals'.

What I should like to do, however, is relate this division between 'head' and 'hand' to views about the relationship between science and technology. Specifically, I wish to follow up a point made by Irving Horowitz that 'the struggle between head and hand is essentially . . . a division between major competing forces for limited resources'.[15]

I don't intend to get bogged down here in the tedious game of attempting definitions of science and technology, or in questions of whether technical innovations are better accounted for by linear-sequential models, either discovery-push or demand-pull, or by branching network models. Let me just say that it seems to me that there is somewhat limited evidence in support of the linear-temporal sequence which has pure science underpinning technology, i.e. that technology is, in effect, only applied science. Science leads, and technology follows in a dependent and subservient position. Rather the situation now is often one in which science and technology have become intermixed and interactive in complex ways which make the distinction between them difficult to maintain, if not meaningless.

However, I would suggest that a profound distinction does remain and that this is social, rather than epistemological or of any other kind. I follow my American namesake Edwin T. Layton here, in his work on the history of engineering. Layton distinguishes between two communities, one that values knowing — the scientists, and one that values doing — the engineers.[16]

The changing relationship between these two communities in this country over the past twenty years has been of some interest to observe. Consider, for example, the views of someone like Sir Patrick Linstead, Rector of Imperial College, and a considerable influence on the Robbins Report in the early 1960s. For Linstead, the education of engineers in his college at that stage was becoming increasingly an education in engineering sciences, the best preparation for which was the study of pure science, especially physics, and mathematics in sixth forms. At a time of shortage of able boys and girls in engineering faculties, there was no suggestion by Linstead that they should do anything other than secure a sound foundation in science and mathematics. Beyond that, a little judicious careers guidance would do the trick.[17]

The return of a Labour Government in 1964, following talk at the Scarborough Conference of 'the white heat of a technological revolution', led to the establishment of a Ministry of Technology, separate from a newly created Department of Education and Science. Schools, universities and the support of scientific research now came under the DES, whilst support for applications of science and development work came under the Ministry of Technology. This organization was in contrast to that recommended in the Robbins Report, that higher education and all research, pure and applied, should be under one ministry, with separate provision for schools.

Predictably Linstead was severely critical of these arrangements, stressing the essential unity of science and technology. As for a proposal then being canvassed for the establishment of a Royal Society of Technology, to do for technology what the Royal Society did so well for science, he dismissed this as thoroughly harmful, institutionalizing a cleavage which should be sealed not widened, and in any case ineffectual because any new body would always be 'a second best and poor relation'. For him, the right step was for the Royal Society to increase its number of annual elections to Fellowships, so making room for some engineers and technologists and retaining for itself the authority to speak for both pure and applied science. Technology, then, was to be contained within science, if not in a position of abject dependence, at least as a subordinate partner.[18]

This situation is somewhat different from that pertaining today. Indeed, the events of the past twenty years can be interpreted as an attempt at a redistribution of power which would give more influence and resources to the *doing*, rather than the *knowing*, community.

In 1965 the Council of Engineering Institutions was established to promote and coordinate the development of 'the science, art and practice of engineering'. Since then we have had the Finniston Report in 1980 and, out of this, the prescribed 'engine of change' intended to achieve a fundamental shift in national priorities, the new Engineering Council.

We now have an E in what was the Science Research Council. SRC has become SERC, although this does not satisfy everyone and the case for a separate Engineering Research Council has been argued strongly in some quarters. Maybe I am unduly sensitized to these matters because in my own university our engineers have recently 'gone autonomous'. What was until a short time ago a single Faculty Board of Science and Applied Science has divided to yield separate and independent Boards of Science and Engineering. As it happens I sit on the Engineering Board, whose deliberations are at times absorbing. What inflames the engineering passions and inspires great feats of oratory is an issue such as whether there should be a higher doctorate, the DEng, comparable to the DSc. And having agreed that there should be, which university committee will deal with applications. The existing DSc committee, an obvious candidate, is unsuitable because the criteria it employs are inappropriate for engineers. It is less a matter of the quality of a man's published papers than whether his pipe lines work.

This bid by the doing community for political and financial emancipation from the knowing community seems to me to be of some significance in any contextual analysis related to the prospect of establishing in schools an alternative, more practically orientated, curriculum. At long last the doing community, at national level, appears to have struck back, achieving a degree of coherence which has been missing in the past.

CONTEXTUAL CHANGES

At this point, I will try to pull together the strands of the argument so far and identify some questions about the appropriateness of the present cultural context for building 'an alternative road'.

First, has the concept of science for its own sake now, if not less validity, at least less practical force or influence? Some pointers to an answer here are increased accountability concerns in relation to scientific research, the large percentage of all scientists presently employed in industry or in other civil and in military establishments, and the increasing association of university science with industry. The Royal Society's recent report on *Science Education 11-18* (1982) stressed that application was an intrinsic part of science and argued that school sciences should be taught in such a way as to emphasise their applicability. This conflicts markedly with the rhetoric accompanying science curricula of twenty years ago. At the time of the Nuffield science teaching projects, applications were shed in favour of an emphasis on conceptual structures and ways of thinking like a scientist.

Second, have our general expectations of the school curriculum undergone change in a direction that might be encouraging to the alternative road? Certainly the economic function of education, its contribution to 'preparation for adult life', and the importance of flexibility, versatility and the acquisition of generic skills, seem to have assumed greater significance. The banners now carry slogans such as 'Skills for Working Life' and 'Education for Capability' rather than references to Paul Hirst's logically distinct and irreducible 'forms of knowledge'.

Third, has there been sufficient yet of a shift in the distribution of power between the 'knowing' and the 'doing' communities to ensure that there is a powerful, supportive, informed and well-resourced national patron for the alternative road? In this connection the first Policy Statement of the new Engineering Council is not without interest because of the emphasis given to the teaching of *technology* in schools, *additional* to science and mathematics, and the concern expressed that greater recognition should be given to courses which adopt a project approach to learning.

Fourth, now that many of the historic factors which shaped our definition of technical education and led to its development largely separate from secondary education, are no longer operative, how feasible is it to rehabilitate the proposal of the Bryce Report of 1895 that secondary education should embrace the idea of technical education? A previous attempt to do so in the 1950s, when the heads of secondary technical schools associated into a pressure group which became in turn the Association for Technical Education in Schools (1964) and then the Association for Technological Education, was not successful. Many of those most intimately involved then were strongly of the opinion that further research and development in connection with the construction of the alternative road was necessary. In practical terms, their efforts contributed to the establishment of the School Council's *Project Technology*. But in 1960, the judgement of one of the leading figures, Edward Semper, Headmaster of Doncaster Technical Grammar School, was that they had 'scarcely begun to develop a practical approach to education in our schools, that is, a practical education making progressively exacting intellectual demands'.[19]

CAN A TECHNICAL EDUCATION BE LIBERAL?

This point leads me directly from contextual influences at national level to the classroom and I want now to review briefly some of the problems from this perspective.

What I take Edward Semper to be saying in the quotation I have just given is that it is not easy to construct a curriculum which has its roots in practical or industrial concerns and which is also liberal in the sense that it develops general intellectual skills and understanding, transferable to and applicable in situations different from those in which the learning had taken place.

Let me offer a specific example. One of the most popular works of 'technical education' at school level in the nineteenth century was J. H. Pepper's *Playbook of Metals*. Pepper, you will recall, was the great showman of nineteenth-century science. His optical illusion, Pepper's ghost, still haunts school physics laboratories and Pepper himself, after working with Barnum and Bailey's circus in the USA, finished his working life as public analyst in Brisbane. He was also the instigator of the Regent Street Polytechnic in London, where he sold science as an entertainment for the masses on a strictly commercial basis for a number of years.

The *Playbook of Metals* went through numerous editions following its appearance in 1861. Though the years of its popularity saw the enunciation of Mendeleeff's Periodic Law, Pepper's account of metallic chemistry remained obstinately uncontaminated by considerations of periodicity to the end. The metallic elements were arranged alphabetically from aluminium to zirconium. Furthermore, elements which from a chemist's standpoint were interesting frequently received scant treatment, whilst others such as iron, silver and gold were the subject of long chapters. Of course, the date of publication provides the clue to the popularity of Pepper's book. It coincided with the discovery of gold in a number of colonies, including Australia, and the *Playbook of Metals* was a prospector's compendium for the young man going overseas to seek his fortune.

The significance of this brief allusion to a specific case of technical education is that prospectors' chemistry does not look like chemists' chemistry. A student of Pepper's book might become a successful gold prospector but he would be hard-pressed to earn his living as a soap manufacturer or a textile chemist, much less as a research chemist in a university. There was little in the book which might be classified as transferable chemical skills or principles. In the same way, chemistry for hairdressers might leave you with an understanding of keratin molecules, sulphur bonds and, today, dye materials, but — unless it also embraced the over-arching principles of chemical science — trapped in the salon for life.

It is all very well, as the Duke of Edinburgh did in his first address to the Association for Science Education, to chide science teachers for their predilection for the fundamental, and to urge them to begin the teaching of Boyle's Law with an explanation of the internal combustion engine, or to describe first how a bicycle transmission works and then explain the principle on which it was based.[20] Not all scientific principles can be easily approached in this way. Try the special theory of relativity. And it is not altogether clear from the examples given what is the role of the application. Is it to serve as some kind of motivation for learning the principle, or is it meant to provide a source from which the principle can be elicited?

The central problem here, then, is one which the secondary technical schools grappled with in the post-war years, but one which — according to Semper — they failed fully to solve before they were overtaken by comprehensive reorganization and lost their identity. Can a school science curriculum which is technical in the sense that it begins with specific applications, and relates to real-life situations, also satisfy the requirements of a liberal education in yielding general, context-independent understandings? Or, putting the matter another way, in attending to the acquisition of general cognitive skills and principles, does the 'technical' course become so similar to the established 'liberal' counterpart, that few teachers will think it worth the effort to make the change? The case of the Joint Matriculation Board's interesting 'A' level syllabus and examination in Engineering Science is perhaps a case in point. Its entries continue to decline — 182 in 1982, compared with almost 16,000 entries in physics — a sad outcome as the Board's report expressed it, 'despite all the educational arguments which are advanced for the subject'.

Incidentally, in passing, it is perhaps worth noting that vocational training (not necessarily the same as technical education, true) in the USA has recently come under vigorous attack following evaluation of its lack of effectiveness. A report from the Carnegie Council has recommended it should be dropped from the school curriculum. As for the liberal education which it is urged should replace vocational training, its advocates now stress the *practical* value of their product. The *New York Times* last year carried an advertisement which read: 'A liberal education prepares you for the challenges you'll face in your first job and throughout your career. It teaches you to communicate, sharpens your decision-making skills and develops your analytical abilities. Most importantly, a liberal education gives you the skills and habits to continue learning throughout your lifetime — an attribute that grows more important each day in a world with rapidly changing technology and complex social and economic problems.'[21]

The wheel has now come full circle and liberal education is justified here in vocational terms.

COMPETING VERSIONS OF SCHOOL TECHNOLOGY

To return to the alternative road in UK secondary schools, the situation since the mid 1960s has been one in which considerable resources have been marshalled in support of school technology. The details of some important developments in this field are provided by Professor Geoffrey Harrison and Professor Jack Standley in later chapters. All I wish to do here is register that one major reason why progress has been less than it might have been is failure to achieve agreement on what school technology should be. Competing definitions, a reflection perhaps of debates at tertiary level about the nature of engineering education, have militated against a coherent and well-coordinated movement for school technology. To what extent should technology be science-based? How important are design considerations? Should it include a technology assessment component? What weight should be accorded to craft skills? How significant is industrial experience? These, and related issues, have divided participants.

Certainly in the late 1960s, when *Project Technology* was being funded by the Schools Council, one can detect in the reactions of both professional science and school science teachers — or at least their representatives amongst officers of the ASE — a distinct reserve, if not hostility, to the idea of school technology. And when, prompted by the Duke of Edinburgh and his socratic friend Sir Harold Hartley, it became clear that the ASE needed to take some initiatives in this field, their preference was for the 'applied physics', analytical, theory-based version of technology which emphasised the applications of scientific principles in subjects such as fluid flow, heat engines, strength of materials and electronics. The ASE found its model for technology in courses such as that developed by Geoffrey Sneed at Ealing Grammar School. This was at the opposite end of the spectrum of possibilities for school technology to the more open-ended, project-orientated, craft and design-influenced work of *Project Technology* under Geoffrey Harrison's direction.[22]

Though much good work was done, the late '60s and early '70s might be seen in retrospect as a period of lost opportunity for the development of school technology. There is a depressing story to be told of crossed lines and strained relations, with the ASE, *Project Technology*, the Schools Council, the CBI and the CEI acting without effective coordination and according to conflicting principles.

The ASE, the leading and most influential of the subject teaching associations, still does not appear to have altogether clarified its position with regard to school technology and the tragedy is that it might simply be overtaken by events here. For those who advocate an alternative road the challenge would appear to be to 'get their act together', to articulate a coherent and convincing philosophy of school technology, or technical education in schools, and one which will command the support of the new 'engine of change', the Engineering Council. I say this because it seems that the advocates of the alternative road have never had a powerful representative of their point of view, comparable to, say, the Royal Society and the scientific institutions for school science. Instead, there has been a disorganized, fragmented national educational representation of the 'doing community', the engineering institutions, the CBI, the Royal Society of Arts and other bodies all with a finger in the pie. Only recently does there seem to be the prospect of a unified and coordinated national body, able to exert influence on behalf of the 'doing community' in the way that has been the case for the 'knowing community'.

THE EXIGENCIES OF THE TEACHER'S WORLD

I said at the beginning of my talk that one of the lessons of the past two decades of curriculum development had been the recognition of the influence on attempted innovations of political, economic, social and other macro-level factors. The other major lesson, I would suggest, relates to the classroom level and to the power of what is sometimes called the teachers' perspective on what takes place in schools. The exigencies of the teachers' world which determine the coping strategies adopted and the selection of concerns and priorities, are familiar enough in general terms, though we still lack any systematic analysis of them, much less one which is related to the institutional context in which teaching takes place.[23] Even so, we can discern certain obstacles to some aspects of the alternative road.

Consider, for example, project work, a central feature of most prescriptions and one by which 'propositional knowledge' — 'mere' book learning — can be transformed into 'knowledge in action'. I recall reading in *Education in Science* as far back as 1968 a detailed examination by Deryk Kelly of the difficulties of implementing project work in schools,[24] and certainly anyone who has worked in an institution of higher education and been involved in the supervision of research dissertations and theses will recognize

— the problem of identifying, selecting and shaping a topic of the right dimensions;

— the problem of achieving a just balance between the input of the teacher and the input of the student;

— the problem of providing supervision — too much prescription and initiative is stifled: too little, and the student may 'flounder' for too long;

— the problem of ensuring that necessary resources are available;

— the problem of assessment — by what criteria?

The list could be extended without difficulty. Cost-benefit judgements have to be made about the demands of project work on the timetable, and maybe on agencies and sources outside the school altogether. There is also the question of the balance of effort that the student puts into the project and into other types of essential learning.

Many of those who make the effort speak enthusiastically about the benefits of project work. The fact remains that it is not always easily compatible with the everyday constraints of schooling. If we add the dimensions of finance and industrial/work experience, the implementation task in relation to the alternative road appears formidable.

PROSPECTS FOR PROGRESS

Are there any indications, then, that the alternative road could be constructed successfully in secondary schools today? What grounds have we for believing that our present effort will be any more successful than previous attempts to establish a practical curriculum?

Certainly both the national and institutional contexts of the school curriculum have been transformed in recent years and the direction of change in each case might be seen as more supportive of 'the alternative road'. The shift towards a greater recognition on the part of professional science of the need to incorporate applications in the teaching of science has already been noted, as has the expression of a coherent, national educational opinion from 'the doing community'. The general economic context, and the belief that a more practical curriculum will better equip young people to enter the world of employment, have not only worked in the same direction but have led to the release of considerable resources, through the agency of the Manpower Services Commission, to support technical and vocational education. This is not to say that all is harmony. The Engineering Council's Policy Statement placed emphasis on the teaching of technology in schools; no such enthusiasm for separate technology is obvious in the Royal Society's report.[25] Within the context of the alternative road, it remains to be seen if technology will become established as a separate school subject which requires a slot in the timetable alongside science and, indeed, in competition with science for time, space and other resources. This would be the curriculum micro-counterpart of events in the world of science and engineering at macro-level.

At the classroom level, changes in technology itself have contributed to a more hospitable context for the alternative road. The possibilities opened up by micro-electronic technology and information technology have made the general educational objectives of school technology — the development of skills of invention and design and of making things which work — much more credible, acceptable and better matched to the everyday constraints of classroom life. The need to formulate precise criteria for the proposed secondary school examination at 16+ and the attempt at national monitoring of the technological attainments of school children by the Department of Education and Science's Assessment of Performance Unit have brought consensus nearer on the objectives of school technology.

Last year in this university we established a Systime Lecture, Systime being a local computer firm with a spectacular growth rate and a generous disposition to educational activities. The first Systime Lecture, *Teaching Microelectronics in Schools*, was delivered by a teacher, David Thompson, Head of Applied Science at Welbeck College, and provides some interesting evidence of the enjoyment and alternative road attainments which his students had manifested in this new field and which he claimed rarely to have detected in his previous experience as a teacher of physics.[26]

I think this sort of reaction is not uncommon. From it, and from other contextual considerations, both macro and micro, to which I have referred, it would appear that, for those convinced of the value of the alternative road, the present is as propitious a time as we have had for many a long year.

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4

State Centralism and the 'Alternative Road' in Higher Technical Education, 1930–1980

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The current wave of concern for technical and vocational education in the schools coincides with a renewed period of anxiety over British economic performance. Since the Second World War, the major decisions in policy for advanced technical education have been taken during such periods, and so this paper seeks to examine the ideals and assumptions which came to the fore at those times, as a backdrop to the present debate.

The perception of unreached possibilities, and the loss of complacency, are prerequisites for the acceptance of change. The decade of the 1930s was not one which anticipated the major changes that war was to bring. Dissatisfaction with British scientific and technological organization was to be found, but the principal pressure groups remained on the fringe of political debate. Those who aspired to a greater degree of central control of science belonged either to the intellectual current which idealized the Soviet Union as mobilizing science for the benefit of the whole community,[1] or to that which was developing notions of a functional–corporatist form of State planning to contain the social effects of unhindered capitalism.[2] Both groups of reformers were without noticeable influence while peace lasted, and even in the wartime emergency their advocacy of central machinery for the oversight and planning of scientific resources went largely unheeded.[3]

For such change to be perceived as desirable, a whole range of social attitudes affecting the application of science in industry would have to alter. Where trade superiority had protected him, the earlier Victorian owner-manager had been complacent: his work-force needed no more than the trusted training of workshop-experience. But if science-based industrial change was to be the norm, as the reforming groups urged, then the managers of new industries had to establish a relationship with this knowledge. This implied a new hierarchy of authority within industry, a hierarchy that maintained its position and that of its organization by fostering the application of new knowledge. Not only the managers, but the other members of the workforce would need training to participate in the new technical processes. Long-standing attitudes that tended to separate theoretical from practical knowledge would have to be dissolved. As Musgrave indicates,[4] market-oriented industrialists had tended to support only those forms of education for their workforce which were general and theoretical, lest their competitors be subsidized through access to specific techniques. Hopes of upward social mobility in the workforce also tended to reinforce suspicion of too practical an education. General education, the ideal of the middle-classes in imitation of their superiors, seemed to be the path to social advancement; works schools were thus regarded with suspicion as the employer's territory, designed for private profit alone. The overall effect was that, despite the support of Lord Eustace Percy at the Board of Education from 1924 to 1929 and a succession of advisory committee reports, the cause was being advocated ahead of its time. Indeed, the Emmott committee of the Association of Teachers in Technical Institutions (ATTI) came to the conclusion in 1927 that while enthusiastic verbal support for technical education could be obtained in industrial opinion surveys, practical encouragement was in no way comparable. All the committees of the period encountered, both at local and at national level, lack of contact and cooperation between industry and further technical education.[5]

At a few points, however, the new technological pattern prevailed.[6] The professional engineering institutions cooperated during the 1930s in the establishment of the Higher National Certificate and Diploma schemes, and the principals of advanced technical colleges where these qualifications were offered began to express their rivalry of the universities in their localities.[7] Lord Percy's *Education at the Crossroads*[8] urged that national salvation required bringing the technical colleges from relative neglect, into a proper relationship with higher education.

In the wartime emergency it proved to be public and parliamentary anxiety, coupled with pressure from professional institutions, that eventually persuaded the central government agencies to take up a directive role in the supply of scientific manpower, such as the radical and reformist groups alike had long been urging.[9] The Ministry of Labour was eventually forced to make a central register of scientists, to recruit specialist panels to assist in their classification, and to appoint itinerant placement officers. There was still less foresight that the demands of war would involve not merely the correct placement of existing skills, but their great expansion. Not until mid-1940 did the extreme urgency of radar requirements result in Cabinet action, and shortly afterwards in the establishment of a Technical Personnel committee to remedy the whole range of shortages that was appearing. In this emergency, the potential tension beween universities and technical colleges as suppliers of specialist skills was temporarily elided. By 1942, three emergency schemes were in operation: state bursaries in science in the universities, accelerated HNC/HND schemes in the advanced technical colleges, and Army engineering cadetships. The technical colleges had already undergone profound changes through the demands of war; the evening-class pattern of decades became three-shift intensive teaching. In the universities, scientific and technical courses had almost total dominance by 1943, arts work having by then been restricted to those unfit for military service.[10]

The urgent demand for technical superiority in war showed how quickly the universities and technical colleges could undergo fundamental changes when once the economic and military importance of a scientific education overtly linked to technological goals became important to the State. Correspondingly, it showed how ready a supply of students, willing to undertake such an education, there could be if once the institutional, professional and financial barriers to it were lowered. One might also argue that the experience of war itself — the untying of social roles, the daily unpredictability — made change seem more normal, just as in the revolutionary atmosphere of England in 1640, France in 1789 or Russia in 1917 the urge to technological advance had been marked.

Despite the rapid rise in the importance of science and technology, contemporary commentators did not fail to notice its wider implications. H. C. Dent, Editor of the *Times Educational Supplement*, remarked that here, entering the university for the first time, was 'a new type of undergraduate, the young scientist whose future services are already earmarked by the State, and whose period of residence is ... (governed by) the nature and quality of the service he will be most fitted to give'.[11] Thus the arrival of the new state bursars in science typified not only the potential ambitions of a rising social group, it raised questions which would take a generation to resolve. Would the post-war State continue to provide the upward ladder for this group? Would it rely mainly on the universities for such a task, or on the advanced technical colleges? If the former, would the arts departments be able to maintain their traditional role in providing entry routes to Civil Service posts that had hitherto demanded no direct knowledge of the sciences? How far would the war experience affect the attitude of industrial leaders towards research-based product policy? Would the State then become involved in seeking an overall coordination of education and industrial policy?[12]

The urgency of these questions led to discussion of the place of science in post-war education that was itself part of the wider debate on the post-war educational structure. For a time, the interests of those who had filled state bursaries in universities, and those who had followed accelerated HNC courses, seemed to coincide, and their common rivalry with older educational ideals was manifest. Yet by the end of the war, two very different paths for future change were to be plotted by different government committees, representing rather closely the ideals of the university and the technical college interests in the field.

THE 'ALTERNATIVE ROAD' IN ASPIRATION AND DEFEAT, 1944–54

As a reforming President of the Board of Education, R. A. Butler saw no reason why his Department's responsibilities should not include the whole of higher education,[13] and he it was who finally gave Lord Eustace Percy the opportunity to develop his views on higher technical education through an official enquiry. The resulting report was predictably oriented to the needs of the advanced sector of technical education.[14] It saw the principal problem as one of maintaining war-time output in mechanical, electrical and civil engineering to fill posts of senior administrators, engineer scientists and development engineers. It argued that only half the requirement could be met by the universities, and that the shortfall should be provided by the advanced technical colleges, offering more full-time courses of degree length and standard. A selected group of institutions should be developed as Colleges of Technology, retaining local administrative and industrial links, but with substantial central government support, and with staff whose status and duties were comparable to those at the universities. Lord Percy's personal view was that these colleges should award a BTech degree, and that as a group they should be developed in all ways necessary to qualify for the grant of university powers. Since this aroused disagreement, he proposed that for the meantime the selected colleges should be entitled Royal Colleges of Technology, with their own associateships and fellowships.

All this was too much for the permanent officials at the Board. They had already laid limited plans to establish a small number of national schools of technology within technical colleges to meet the requirements of specific industries, and internal memoranda show that these proposals, as incorporated into Lord Percy's report, were all that they intended to proceed with.[15] The national colleges were duly established in close connection with specific industries, but no action was forthcoming on the Percy proposal to designate major colleges of technology.[16] A cumbersome Regional Advisory Council structure to coordinate university-technical college interests was set up; a National Advisory Council (NACEIC) was established whose position in principle paralleled that of the University Grants Committee (UGC), but in practice it had little power, since no move was made to establish capital grants for the colleges or to suggest that the NACEIC might advise on their application. Very little action was taken to forward the Percy concept of parity between advanced technical education and the universities, through research facilities, transfer of students and interchanges of staff. Whereas over 6,000 students had received state bursaries by 1945, the scheme received only nominal support after the war, with only 100 Technical State Scholarships being awarded in 1947. Although there were considerably more students qualifying than before the war (ONC 9739/1949 from 3313/1938; HNC 4241 from 1137), these certificate students, who attended part-time from the age of 16, continued greatly to exceed the diploma stream, which attended full-time for three years from 18; their numbers were OND 348 from 95, HND 287 from 37. The picture which is conveyed by Venables' painstaking survey of 1955, of austerity and restriction for higher technical education in a period when the universities received unprecedented support, is difficult to question.[17]

THE 'HIGH ROAD' IN EXPANSION, 1944–54

In retrospect, it is striking that the educational strategy of both the 1945–50 Labour Government and the 1951–55 Conservative administration had such similar consequences, and that both excluded serious implementation of Percy's proposals. This was the period of the great influence of the lobby for expanding science education through the universities which, after neglect and studied disinterest by successive Lord Presidents before and during the war, finally found a champion in Herbert Morrison, at a time when the Treasury had decided that this element of the campaign of the science policy advocates at least deserved attention.[18] The resulting committee of enquiry under Sir Alan Barlow made proposals for the doubling of the universities' output of scientists within five years that the UGC at first refused to take seriously. The fact that this plan was eventually implemented was due principally to the assistance given to the science lobby's case by the alliance formed between Tizard, its representative on the UGC, and Tawney, also active on the committee, and the principal architect of Labour's education policy.[19]

Tawney, with Sir Ernest Barker and Percy Nunn, had been the major formulator of the Hadow report on the education of the adolescent, which with its proposals for universal secondary education was the basis of the 1944 Education Act. He saw the main aim of socialist politics as 'bringing the underprivileged into the big time-tested House of Britain, with its obvious benefits and qualities'.[20] He supported university expansion on these grounds: if the smaller provincial universities could be brought to adequate size and standard, then the necessary places to accommodate the underprivileged could be provided.[21] In his joint memorandum with Tizard, this strategy of Tawney's blends imperceptibly with the science lobby's case for wider application of science in industry; the increased *demand* for university education is emphasized alongside the expectation that the lessons of wartime will lead to a greater willingness of business firms to take science graduates into their employment.[22] The same dual appeal to widened educational opportunity and to national technical needs is apparent in Herbert Morrison's case to the Cabinet in 1946 for accepting the revised terms of reference for the UGC which were part of the arrangements reached for acceding to the demands of Tizard and Tawney to implement the Barlow proposals.

> 'I am not sure whether as a government we have yet faced the full implications of the unprecedented demands which will be made on the universities if the country is to get from them the men and women it needs for the purposes and of the quality it requires. Teachers, administrators, economists, scientists, doctors, to take but a few examples, will be wanted in vastly increased numbers. It is our ultimate

> aim to give a University education to every boy or girl who can benefit from it'.[23]

This alliance between the science planners and the reform socialism of Tawney implied a concentration on the expansion of university-based education, and this had its consequences in the post-war years. By 1950 the Percy recommendations had received attention mainly at the level of administrative rearrangement, with little additional financial assistance, whereas the grant to universities increased sharply, and the target of doubled science numbers set by Barlow was achieved ahead of time.[24] The reluctance of the Board of Education's officials to proceed with its more radical proposals for developing major technical colleges, was mirrored by the determination of the Vice-Chancellors' committee (CVCP) to expand existing institutions rather than found a new university.[25]

For a brief period in 1951–52 it seemed that this alliance between the aspirations of radical democracy, and the expansion of existing institutions favoured by the science lobby, would break, opening the way for the strong non-metropolitan aspirations of the advanced technical colleges. A report from the NACEIC in 1950 urged renewed attention to the non-university advanced sector, and just before its defeat, the Labour Government issued a White Paper on Technical Education which gave limited encouragement by endorsing the proposal for a College of Technologists to grant awards.[26] However, a month later the Conservatives were returned before it could be seen how far the Labour Party was prepared to continue such strong encouragement to the technical colleges.

At first, it seemed that the incoming government would implement the proposal for a technological university, which was the inverse of the strategy favoured by the Percy/NACEIC lobby. A strong body of opinion in the university-based science-planning lobby (which now had a permanent successor to the Barlow enquiry in the form of the Advisory Council for Scientific Policy (ACSP)) favoured the establishment of a new technological institution comparable to the Massachusetts Institute of Technology or the Technische Hochschüle, Zürich.[27] The whole of the ACSP certainly favoured autonomous teaching and research institutes in technology within the university system, independent of existing departments.[28] While still on the Opposition benches, Mr R. A. Butler wrote at this time that one or more technological institutions 'which could look Delft and Zürich in the face' would be preferable to the Percy/NACEIC proposal to improve certain colleges to advanced level.[29]

However, the UGC took the unusual step of publishing its view on the controversy, making clear that it opposed the continental pattern of separating technological training into separate institutions, and thus the technological university beloved of Mr Butler and Lord Cherwell in the Conservative Party and Sir Solly Zuckerman and Sir John Cockcroft in the ACSP. On the contrary, it argued, teaching and research in technology needed to be associated still more closely with the sciences in a university setting, and its students needed contact with the whole body of higher education.[30] At first, the incoming government did not heed this advice: Mr Butler became Chancellor, and in announcing abandonment of the Labour White Paper, declared the Conservatives' intention to develop a technological university.[31] However, in time the UGC view prevailed: Lord Woolton was deputed to weigh up the alternatives, and in due course the government decided after all to expand an existing institution: the enlargement of Imperial College was accordingly announced in 1953.[32]

After this short skirmish, the Conservative government took over the task of enlarging the 'high road' into technological education that had been started by the 1945 administration. Industrial opinion as represented by the Federation of British Industries (FBI) was in line with the policy of very limited change in the technical colleges, the support of National Colleges in specific technologies, and the concentration of advanced technical education in the universities.[33] There was no conference on Technical Colleges and Industry until 1954, indicating that the FBI regarded the technical colleges as inferior in status to the universities. It was not therefore surprising that Conservative policy from 1951 to 1955 gave little encouragement to the formation of a higher technological education system. Their approach could rather be characterized by the phrase used by Lord Woolton in a 1952 statement: '... we must develop our world trade if we are to live ... (so) ... we must take active steps to train an officer class for industry'.[34] Effectively he rejected both the Percy/NACEIC lobby, and the call of the ACSP that 'a substantial increase in scientific manpower is essential in the interests of technical and industrial efficiency'. Woolton preferred to go at the pace of industry: 'I cannot hold out to your Lordships any hope of an immediate and dramatic increase in the facilities for the training of higher technologists to ensure that top level men will be trained in the numbers likely to be required. Here supply must wait on demand'. Thus there was little urgency about government policy in this period. Its loyalties were to the pace of industrial demand and to the UGC as the body trusted to adjust to it, rather than the pace forced by either the ACSP or the NACEIC. It was anxious not to disturb the local roots of the technical colleges: although it increased their grant for advanced work, it regarded any graduate-equivalent technologists they did produce as essentially a by-product of their main activity.

In this period, the twin controversies over the technological university and over the Royal College of Technologists were symbolic of the aspirations of two rising groups which encountered resistance. Within the ACSP, the split over the technological university proposal revealed the belief of some of its members that even the nineteenth-century civic universities had lost their zeal for contributing to community wealth-making. This comes out neatly in the view of Lord Cherwell: 'In my opinion, the mistake was in submitting the conclusions of the Cabinet (which had decided that there should be three technological universities) to the judgement of the UGC. One might as well consult the bench of Bishops about spending money on increasing the number of unitarian preachers ... all I object to is the assumption of the humanists that they enjoy a sort of effortless superiority over all others ...'.[35] But the enemy was nearer at hand than the arts members of the UGC. It was apparent in the UGC's *Note on Technology* that the objections of scientists to rivalry of their departments had counted in the decision to reject the proposal for special technological institutes.[36] In effect, an uneasy truce over university technology had been reached by 1954 — a truce that was to continue to shape future decisions even when battle broke out again over technological education in 1955–56. For the College of Technologists proposal symbolized the attempt to establish an accepted economic and professional role for a rising group that rivalled the university-trained engineer. The policy decisions of 1956 mark the acceptance of these aspirations, albeit with subtle modifications.

THE TECHNOLOGICAL STATE AS THREAT AND AS IDEAL, 1954–61

By the mid-1950s, industrial opinion on advanced technological education was beginning to shift towards recognition of the need for advanced training of the specialized group, neither scientists nor technicians, upon whom newer industries increasingly depended. Industrial leaders at FBI conferences were becoming reconciled to the cost of supporting more advanced education beyond the now inadequate provisions of part-time day-release training.[37] The Department of Education responded to the changed situation; in July 1955 Sir David Eccles outlined to Parliament his new policy for an 'alternative road'.[38] He indicated his sensitivity to industrial demand, to the fact that he was finally opening a new path for social ambition — 'children not on the university ladder will not now be debarred from a chance for rising' — and to the jealousy of the universities. Diplomas, not degrees, would be awarded; any institution which could obtain Ministry approval for its standards would offer the award, and the local authorities would retain a large degree of control over them. In effect, the non-metropolitan route into technical education proposed by Lord Eustace Percy thirty years earlier was to be implemented now that industrial leaders had finally accepted the need for it.

When in July 1955 the *Times Educational Supplement* commented on the new technical awards structure, it made no reference to international competition from the USA or the USSR.[39] However, a National Science Foundation study of American professional manpower published that month[40] aroused widespread concern. Soon a *Times* leading article referred to 'cause for alarm' that 'the proportion of technologists ... is much smaller than in other major industrial countries'.[41] In the subsequent months, the most urgent interpretations of failings in science and engineering education came from the existing leaders of the science policy lobby. Lord Simon wrote of the 'almost desperate urgency of the need for more engineers', and his international comparisons were drawn almost wholly with the USSR.[42] Sir Solly Zuckerman, Chairman of the ACSP, also drew alarming conclusions from the NSF study, using the phrase 'the cold war of the classrooms', itself an engineer's designation, coming from Strauss, the Chairman of the United States Atomic Energy Commission.

> 'The nations are ... in a race to transform themselves scientifically, not because of any fundamental belief that natural science possesses any greater educational or intellectual merit than the humanities, but because of the realization that in a competitive world, science and technology provide the key to higher material standards of living and economic and military power.'[43]

Sir Winston Churchill then lent his support to the competitive model, so far pressed by scientists and engineers:

> 'This is an all-important subject ... We are already surpassed by Russia on a scale that is most alarming ... This is a matter which demands the immediate attention of Her Majesty's Government.'[44]

A White Paper on Technical Education was due in early 1956, and in anticipation, the leader-writers sensed the potential clash between the apostles of urgency, and the structure of existing educational systems and values. *Nature* was inclined to doubt the value of comparisons with widely differing social systems, and pointed out that the superiority of the USSR was much less apparent when her total numbers of trained professionals were considered.[45] The *Times*, by now recovering its nerve, argued that

> 'The size of the Russian challenge is an argument for a sensible adjustment. Where the real Russian advantage lies at the moment is at the second or technical college level. The British Government's plans for technological expansion in the universities probably go far enough. The need is for a great increase in the output from the technical colleges.'[46]

In effect, that is what happened at the level of political decision-making during 1956. The force of the panic over Soviet and American superiority was diverted into the policy already drafted by Sir David Eccles. Nevertheless, the public argument continued; on 8 September 1956 C. P. (later Lord) Snow published anonymously an article, 'New Minds for New Worlds', that was to be widely quoted, and that foreshadowed the 'Two Cultures' debate which he initiated in the late 1950s. The article spelled out the aspirations of progressive scientists and engineers for the transformation of national culture by the acceptance of goals derived from science and technology, in order to ensure economic survival. Cold-war tension was apparent from the outset: 'We have either got to learn physics and mathematics — or else Russian.' 'Until America and Great Britain can train a commensurate population of scientific minds, Bernal and Joliot-Curie will not have been proved wrong (i.e. in believing that Communism and science are one).' The admission of scientists and engineers into a place of honour in our society was strongly pressed as the solution to economic ills.

> 'Our present culture is of course unscientific. It is also in part anti-scientific ... What they (i.e. the people who form it) would like ... is to keep the present culture intact, and tag on a kind of annex of professional

science and engineering. It is a failure ... to believe that the problem can be solved like that. The present culture seeps mildly round us who have been brought up in it ... Nevertheless the first virtue of a society is to be able to survive. If the price of survival is to change our culture, most of us as individuals would pay more than that.'[47]

Already the White Paper of that year had used similar language. It opened with the words which Sir Anthony Eden had spoken in the Commons when repeatedly challenged with what Sir Winston Churchill had said in his constituency: 'The countries with the best systems of education will win ... I am determined that this shortage (i.e. of scientists and engineers) shall be made good.'[48] It went on to repeat the figures on training disparities in alarming form, thus lending weight to the opinion of the *Times Educational Supplement* that 'Now that the implications of the figures [on Soviet manpower] are properly understood, there is an anxiety approaching panic in high places.'[49]

However, the main practical modifications to Eccles's original plan were all in the direction of greater professional and metropolitan control over the colleges and their curriculum. The engineering institutions had intervened to protest at the proliferation of courses, and this by implication threatened the locally-based traditions of existing colleges.[50] The Minister now listed the twenty-four colleges receiving 75% grant for advanced work, and indicated that he expected them rapidly to develop into colleges of advanced technology (CATs). The argument that such colleges could not be successfully administered within local government was still rejected; Burgess and Pratt consider that this was to retain support for the Ministry while the next step was planned.[51] In the summer of 1956 Eccles moved still further in the direction of metropolitan-style institutions, giving stronger assent to the view that adequate standards could not be reached at a widely dispersed range of colleges. Eight CATs were designated, with two more to follow, rather than twenty-four.[52]

The 'alternative road' was thus established, but, after three drafts, it looked more and more like an alternative university sector, even though the granting of degree powers was still ruled out. In the aftermath of the decision, the ACSP attempted to shift back more of the expansion programme into the university sector.[53] Lord Simon returned to the attack, calling for a university programme to match that of the technical colleges, but it proved impossible to divert the government from their commitment to the new sector.[54]

THE COMMUNITY SERVICE UNIVERSITY AND THE POLITICS OF MODERNIZATION, 1961–64

In the late 1950s the new CATs experienced a much greater demand for DipTech places than had been thought likely in 1956; the universities encountered great pressure for admission to places in science and to a lesser extent in technology, and they increasingly adopted a demand-led planning policy. By 1962, the ambitions of the CATs were apparent in demands for research support comparable to the universities made by the teaching unions and the college principals in evidence to the Robbins Committee.[55] Again, in 1962, the ambitions of the universities were checked when the government openly rejected the UGC's expansionist plans for the quinquennium, and came into collision with teaching staff over salaries. The abandonment of an independent nuclear deterrent led to repeated calls to recover expenditure from military work for civilian university research.

In 1955–56, public anxiety about technological competition was effectively absorbed by the government's willingness to expand advanced colleges. In the late years of the Macmillan-Home administration, a comparable but more searching debate took place. As in 1956, when the international tensions of the cold war were reflected in the polemical use of the Soviet manpower figures, so in 1963, when the 'special relationship' with the USA was cast in doubt for the first time since the war, when defence policies were in disarray, and the Common Market would provide no haven, there was once again an upsurge of the utopianism of engineering optimism. 'It was this mood that Harold Wilson seized upon ... in January 1963. From the beginning he sought to build an image of professional skill and managerial competence, symbolized by his pronounced identification with the "scientific revolution".'[56] Mark Abrams, whose surveys were influential in the formation of Labour strategy, emphasized the desire of floating voters for 'a government which will be competent and expert, and they will vote for whichever party seems currently to produce the better managerial performance'.[57]

With the scientific community thwarted in its continued expansion, and the balance of electoral power believed to be held by a group which, if not actually identical with that community, yet sharing some of its preconceptions about political priorities, there was a shift in influence towards the politics of planning in both Conservative and Labour parties which was to have a profound influence about the debate on the future of higher education and the place of science and technology within it.[58]

In the Labour Party, Harold Wilson was closely identified with the stress on technology policy as the determinant of social and economic structure introduced in the 1960 and 1961 programmes. After Gaitskell's early death, Wilson was able as leader to influence the party further with the ideas of his previously insecure Science and Industry group. Crossman now became its chairman, and the group defeated the Gaitskellite wing, which had concentrated on the provision of university places in isolation from economic-industrial policy. With Terry Pitt, Crossman prepared the 1963 conference statement, *Labour and the Scientific Revolution*, which urged that the universities be the servants of the planned technological state.

> 'In planning this new expansion programme, we must reject the idea that the university is a small and isolated community of scholars. On the contrary, (they) must be ... deliberately sited so that they are in close and continuous touch with the life and needs of the nation.'

It followed that the academic status of the CATs should be raised.

> 'Indeed, we believe that it is essential to break down the barriers that now so absurdly exist between different academic institutions, those that separate scientists in industry from the universities, and scientists in government from both. To this end we will at once raise the CATs to full university status ...'[59]

Lord Eustace Percy had been saying much the same in 1930; what was striking was that the issue should be a visible and integral part of the policy of a national party. The main tone of the statement was set by an appeal to the anxieties and ambitions of the scientific community, and the presumed ideals of the 'modernizing' floating voter. The interests of the working man, and the benevolent planning of a government dedicated to science, were held to be at one. And the link between them would be the community-oriented universities and retraining centres, each dedicated to the continuous renewal of skills to allow unimpeded technological change towards the ideal working State.

That such a continuous social renewal would permanently change the balance between technical and humanistic studies in the universities, and the balance of skills in the administrative classes, was evident in an article by Crossman the following spring. His programme for scientific administration recalled that of C. P. Snow in 1956 — indeed, that of his more recent 'Two Cultures' lectures — but now with an open prospect of its practical establishment.

> 'History now requires of each industrialized nation, a continuous and purposive adaptation to its environment. And this means that our British establishment must become "science-based" ... I would hope that ... we shall be able to achieve not only a fair balance between scientists and humanists at the top of the Civil Service, but also a new kind of Civil Servant whose general education is both scientific and humane.'[60]

Had the Conservative party sought to protect the arts-based route from the universities to the Civil Service at all costs against the threat of the Wilson-Crossman programme, then there might have been a 'social upheaval, directed against the public schools, the ancient universities and the arts degrees in particular', about which an anonymous *Times Educational Supplement* contributor had speculated in 1956.[61]

The Conservatives were, however, themselves in an inner transformation. Lord Hailsham, Minister for Science and defender of the freedom of science and the autonomy of learning, lost ground to the men who from 1961 onwards reconciled the Party to a measure of State intervention in planning the economy and in directing technology. Aubrey Jones was active in convincing the FBI in favour of forward planning of State economic activity; Harold Macmillan backed Selwyn Lloyd in bringing to fruition the corporatist ideas with which he had been associated since the 1930s in establishing a National Economic Development Commission (NEDC).[62] Within the Party, the lead of Aubrey Jones was consolidated by a committee under Robert (later Sir Robert) Carr, which in 1962 suggested that the NEDC 'take the lead in relating economic forecasting to scientific and technological needs'. In the Party booklet *Science and Society* of 1962, it is striking to see Jones's paper alongside Hailsham's defence of decentralized, peer-group directed management of science. Jones returned to the instrumental, competitive view of science in terms as strong as any used in 1956.

> 'One cannot engage effectively in the struggle with the Soviet Union for competitive coexistence, without treating science and technology on something approaching Soviet terms… You may be wedded to your liberties, but if you are engaged in a hot war, you have to some extent to abandon your liberties. I suggest to you that exactly the same is true of a cold war.'[63]

No less than Crossman did Jones hide his admiration of government by scientists and engineers. The identification of scientific achievement and political achievement was for Jones 'the crucial difference between the Soviet Union and this country'.

It was in this climate that the crucial transition of the UGC from Treasury to DES control was effected. Evidence to the Robbins Committee showed that the universities were beginning to see themselves as part of a common system with the CATs, and this meant agreement with their desire for admission to Grants Committee financing. The Treasury was nervous of taking over wider responsibilities now that higher education was increasingly controversial. The UGC in this situation wanted to continue under the protection of a small Department such as the Ministry of Science.[64] The alternative, Ministry of Education control, would, the UGC feared, mean the full integration of university education with national planning that Crossman and Jones advocated. The Ministry of Education memorandum indicated that this would indeed be its wish. It identified itself with the 1960 Political and Economic Planning Report (itself one of the stimuli to the NEDC's formation) in urging a coordinated manpower programme spanning all sectors of education.[65] Sir Anthony Part in evidence resisted strongly any splitting off of universities and CATs from their overall responsibility for national education.[66] It was evident that, underlying his Ministry's opposition, was a philosophy of the university as fundamentally part of the national economy, and thus inseparable from national manpower planning in all fields — a philosophy, opposition to which had for so long divided the universities from the 'alternative road'.

In the Robbins Committee itself, the Ministry of Education lost its case. The research orientation of the universities was considered to override their links with the schools, as the UGC, the ACSP and the Treasury had argued. Robbins proposed a Minister for Arts and Sciences, responsible for existing and new technological universities, research councils and the arts.[67] The outgoing Conservative government accepted this proposal for a short while, but soon found itself unable to resist the pressure of its own planning lobby, and established a new federal ministry with responsibility for the whole of education and science.[68]

EPILOGUE

The desire of the reformers, Crossman and Jones alike, was to set the *whole* university system on the 'alternative road'. When the Robbins Committee accepted the notion of education as an investment in the skills needed for economic growth, and threatened that such growth might be unattainable without expanding higher education, the triumph of the ideas of national economic planning was manifest.[69] For in the minds of the planners, the paramount idea was of education as providing a reserve of knowledge in the population, to be used instrumentally in constant adaptation to social change through transmission and renewal of that knowledge.

Thus the recognition of the academic status of technology in the university became almost impossible to oppose; once the instrumental function of knowledge is widely accepted, any basis for denying status to the college of technology, itself dedicated to supplying the skills of the knowledge-based professions, disappears. It is significant that this culminating decision, like those of 1945–6 and 1955–6, was made at a time of perceived crisis. Increasingly the analogy of 'permanent war' was used to justify change. Thus Crossman in 1963 idealized the war-time administration of Britain as 'that of probably the best-governed country in the world'; it was 'in the truest sense science-based, and also social science based'. He believed that such an alliance between scientists and administrators should be perpetuated, because

> 'In the technological revolution to which we are now committed, we shall be in a state of permanent emergency … There are two ways in which peace-time planning resembles war-time planning: it requires definition of clearly defined targets to which the community's efforts can be directed, and it can only successfully be achieved by the systematic use of scientific methods, both in the investigation which precedes selection of the aims, and in the plans worked out in order to achieve them.'[70]

To such a mind, the administration of the State and the means of production are alike machines, to which the upwardly mobile technological class deserves full academic accreditation once it is skilled in the task of guiding their mechanisms to scientific perfection. Technology becomes the rationale of the university; the 'alternative road' and the 'high road' are one.

Since 1965, we have seen repeated efforts to challenge this outcome. Anthony Crosland's Woolwich speech of 1965 rejected Robbins' unitary view of higher education, and re-affirmed the distinctness of the two roads in a binary policy.[71] Sir Toby Weaver's continuous support, as Deputy Secretary at the DES, was for a policy of expanding higher education by means other than the expansion of universities, other than by the continuous expansion of scholarship. 'Most of us are not going to be what Steiner calls *homo cogitans*. We are going to problem-solvers — of personal, social, political or organizational problems.'[72]

This is the philosophy that underlies the current campaign for Education for Capability, and its extension, the MSC initiative for 14–18 year-old technical training in the schools. It is notable that a new generation of prophets of industrial decline — Barnett, Roderick and Stephens, and Wiener — has arisen to reinforce the new campaign for an 'alternative road' in schools as well as higher education.[73]

What is the significance of this recurrent conflict? If by the 1960s the campaign of the Eustace Percy generation for an 'alternative road' had been accepted with the co-option of the CATs into the university sector, why have we seen another generation 'starting again', against all the forces of 'academic drift' that Burgess and Pratt have documented?[74] Tom Nairn has suggested that the Industrial Revolution in Britain has been incomplete; its external maritime and financial dominance has allowed it to survive internally without pursuing industrial logic to the full. Nairn clearly believes that a second, radical-liberal revolution is needed to meet the demands of the industrial age, but that it is prevented because of the accommodation of the middle classes to a less demanding view of their industrial role, symbolized by their assimilation into the pre-industrial patrician social structure.[75]

On that view, the account given here of the absorption of the Colleges of Advanced Technology into the university sector, and their subsequent weak support culminating in the UGC cuts of 1981, could be read as the co-option and defeat of a potentially 'radical' movement. Certainly, the continuity between the campaigns of Lord Eustace Percy, Lord Simon, Lord Snow and the 'modernizers' of our own day could well be seen as successive outbreaks of 'radical' liberalism against 'patrician' liberalism. However, that interpretation depends on the assumption that the alignment of ever-increasing sectors of education with industrial goals of the type that have dominated the last two centuries in Europe, is a precondition for, and enabling factor in, renewed economic prosperity. The use of such rhetoric by earlier proponents of advanced technological education to accompany changed social and managerial status of technologists in society, suggests that it will be important to see whether the MSC's current initiative in practice favours a similar upwardly-mobile group in industry. Or will it assist in reorienting society to those occupations and activities which will be needed for privileged and under-privileged groups alike in the coming years when, as seems likely, the current paradigm of industrial society fails to sustain a genuinely human community, and the pursuit of industrial competition for its own sake is realized to be a profound distortion of the needs and purposes of persons?[76]

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5

Views of the Alternative Road: the Crowther Concept

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According to *The Times*, 1 September 1983 was 'a bench mark in British social policy' because of the launching of the Manpower Services Commission's Youth Training Scheme.[1] Such 'bench marks' are always in the eye of the beholder, and often fade with the passage of time. The publication of the Crowther report, *15 to 18*, in December 1959 was greeted with equally extravagant acclaim. The *Daily Mirror* described it as 'the most vital report ever written on education', while according to the *Daily Sketch*, 'To describe the report as sensational would be an under-statement.'[2] Several recommendations in the Report attracted strong support, particularly the raising of the school-leaving age from fifteen to sixteen, and the provision of compulsory part-time education for all young persons of sixteen and seventeen who were not engaged in full-time education. Perhaps the most important section of the Report, certainly in the opinion of Crowther himself, was Chapter 35, entitled 'The Alternative Road'. This idea of the 'alternative road' constituted one of the most interesting initiatives in 'rehabilitating the practical' to have been put forward in Britain over the past fifty years, but its implications have tended to be either neglected or distorted.

In the post-war period, a rapid increase in national demand for scientists and technologists helped to stimulate an expansion of provision at various stages of education. It was soon evident that the universities on their own would not be able to expand sufficiently to cater for this anticipated manpower demand, especially with regard to applied scientists and technologists. Support for an extension of higher technological education therefore began to grow.[3] The proposals of the Percy report, which had suggested new avenues of expansion in higher technological education as early as 1945, were acted upon in the 1950s.[4]

At the same time, attention was increasingly directed towards the problems of secondary education. An expansion in higher education facilities would be of little value if increased numbers of able recruits were not forthcoming from the schools. The secondary schools, and particularly the established grammar schools, were expected to provide these potential recruits. The grammar schools were hampered in responding to these new and urgent requirements by a 'serious shortage in the supply of science teachers'.[5] However, the 'vocal and insistent' demand for attention to be given to the training of scientists and technologists was recognized by the grammar-school-based science teaching associations and such interest-groups as the Incorporated Association of Head Masters (IAHM). F.L. Allan of the IAHM noted that increased economic productivity would require larger numbers of highly skilled technologists; 'This brings us back to the output from the universities, and the universities in turn depend on their intake from the schools. The Sixth Forms in the Public Schools and Grammar Schools are therefore the key to the whole position.'[6] The Science Masters' Association (SMA) sought to respond by emphasizing the social value of science as it had long been taught in most grammar and public schools — liberal in approach, cultural in scope, and rigorous in its intellectual and academic demands. Both the SMA and the IAHM argued strongly that science in the grammar schools should continue to provide a solid grounding in scientific principles rather than any specifically vocational preparation. This established approach, it was claimed, would produce many more high-quality recruits for science and technology than any attempt to introduce specialized training at the school level. As A.G. Russell, the president of the IAHM, declared in 1956, 'We do not aim to turn out "specialists" — we try to build the foundations on which a large number of "specialisms" can ultimately be erected.'[7] Thus, it was argued, a secure understanding of general scientific principles was the essential prerequisite for training in technology and engineering just as much as for scientific research. The SMA did acknowledge that there was 'a need to stimulate or maintain pupils' interest in engineering while they are at school', but insisted that this should only happen after a solid foundation of scientific principles had been laid:

> 'Proposals have been made to include in the school curriculum some studies which are labelled "Engineering" and include some practice or technology which is not normally touched upon until a later stage in technical education. The view taken here is that such studies are inappropriate if they lead to a reduction of science studies in order to find room for some elementary technology.'

It conceded that 'It might be that science teachers, through lack of information and a natural shortage of personal experience, do not quote engineering applications when, perhaps, they might with advantage', but it concluded, somewhat optimistically, that this matter could 'be safely left to the judgement of the science teachers'.[8]

However, it was widely recognized that this approach was not suitable for all pupils, and that other avenues needed to be pursued if scientific and technological manpower were to be increased sufficiently to meet the perceived national need. The Minister of Education, Sir David Eccles, was not convinced that a higher proportion of children should be allocated to grammar schools.[9] It was also clear that many pupils who might benefit from further educational provision were leaving school at the minimum leaving age, and the question of how to cater for this 'wasted talent' became a major issue.[10] Secondary technical schools had been established in the 1940s to provide a less academic approach than that associated with the grammar schools, but hoping for an equal quality of intake and 'selecting the sphere of industry or commerce as their particular link with the adult world'.[11] However, by the 1950s only a few hundred of these schools had been formed, and they were beset with difficulties concerning selection, assessment and rationale, besides being almost ignored by the public, many LEAs, most educational pressure groups and political and industrial concerns.[12] Another problem was how to integrate the many and varied institutions of further education with the rest of educational provision in order to provide greater numbers of qualified technologists and technicians.

Eccles himself was particularly concerned to improve and extend the system of further education in England and Wales. He hoped that by widening the interests and the appeal of technical colleges, while also increasing their numbers, they might be better placed to satisfy the growing demand for technological manpower. In 1955, he appointed a National Council, to be headed by Lord Hives, the chairman of Rolls-Royce, for making awards to successful technological students in technical colleges. The purpose of this was to encourage the creation of 'a broad road to the top of the technical tree alternative to the normal university route'.[13] In February 1956, a four-year programme of investment for technical colleges of £85 million was announced by the White Paper *Technical Education*. This document stressed the danger of the English system of technical education being left behind by those in the United States, the Soviet Union and western Europe.[14] It also declared that technical education should be flexible and versatile rather than 'narrowly vocational'. It was evidently hoped that broader and more liberal courses in the expanding technical colleges would attract more recruits from secondary education.[15] The White Paper emphasized that the phases of secondary education and further education should be much better integrated than they were at present. Further expansion of the technical colleges, it pointed out, depended upon 'strengthening the base of the pyramid of technical education by improving the education in the schools and raising the numbers of school-leavers who are able and willing to take successfully the courses offered at technical colleges'.[16] The creation of the Hives awards, and the publication of the *Technical Education* White Paper, seem to have represented part of an attempt to identify a 'practical route' in education, comparable in stature to the 'academic route' provided by the grammar schools and universities but appealing to a different type of pupil. These initiatives were also designed to encourage intellectual and liberal qualities in the pupils using the 'practical route'. However, it was not clear how this 'practical route' should be developed and sustained, nor how to forge a distinctive and coherent rationale for all types of 'practical' education. It was surely no coincidence that only a few weeks after the publication of the White Paper, Eccles invited the Central Advisory Council for Education to investigate the education of boys and girls of between fifteen and eighteen years of age.

The Advisory Council began its inquiry into this subject in March 1956, chaired by Geoffrey Crowther, the deputy-chairman of the Economist Newspaper, Ltd. Born in Leeds, Crowther had been educated at Leeds Grammar School and then at Oundle, and then Cambridge; perhaps not surprisingly, he had a reputation as a 'pragmatist' in educational matters. Also, despite his Double First in economics at Cambridge, he was not an academic economist, preferring to concentrate upon his business and publishing interests. This predilection inspired one commentator to observe that 'In business as in economics as in education Crowther prefers the practice to the theory'.[17] The report produced by Crowther in 1959 gave added weight to this view.

The committee itself was composed of seven representatives from the universities, two from the local authorities, two from technical colleges, seven from schools (maintained and independent), one from the field of teacher training, two from trade unions, two from employers and three from elsewhere.[18] It was immediately divided into three 'fact-finding' groups concerned with the 'channels and avenues of flow through the schools via further education to different levels of employment'. Group A was to concentrate on the problems of sixth-form pupils, and Group C on the less able pupils in secondary modern schools who were currently failing to find a place in sixth-forms or further education. Group B was intended to work out a coherent relationship between the various commercial, technical and industrial courses in many different types of institutions which were then on offer, in order that the committee as a whole might then be able to define and recommend a viable 'practical route' within the English educational system. This was no easy task. It was admitted that this group 'offered the greatest difficulty of demarcation, and in certain fields might require a negative definition i.e. boys and girls not clearly falling into A or C'.[19] In practice, Group B aimed to cater for 'those boys and girls whose careers demand some formal education beyond the age of 15 but whose probable "ceiling" is below professional status'.[20] It wrestled with the problem of identifying a 'practical route' for such pupils, and formulating a clear rationale for this route. Influential members of this 'technical group' on the Crowther committee included Dr H. Frazer, head of Gateway Boys' School in Leicester, Dr P. F. R. Venables, principal of the College of Advanced Technology in Birmingham, and Mr George Bosworth, chief technical personnel administrator at the English Electric Company. The title of the group was changed to

Group L when it was recognized that the former rotation of the groups, A, B and C, might imply an order of precedence; but the effect of this change was rather spoiled because Group A duly became Group K and Group C was restyled Group M.

The difficulties involved in 'strengthening the base of the pyramid of technical education' engaged much of the attention of the technical group. The secondary technical schools were seen as providing, at least potentially, a useful avenue for secondary school pupils to proceed into further education. Crowther himself equated 'the curriculum of secondary technical education' with 'the education in the schools of those who are proceeding to Technical Colleges'. In his view, the question of 'the future of the Secondary Technical School' was closely related to the wider issue of 'what can be done to swell the volume and improve the quality of entrants to the Technical Colleges'.[21] However, members were unsure as to exactly how the education offered in secondary technical schools differed from that in grammar schools. Dr Frazer circulated a lengthy note on the background and purposes of secondary technical schools, arguing that grammar schools had generally resisted the introduction of technical subjects into the curriculum, and that such subjects could therefore only be encouraged through the establishment and further development of independent secondary technical schools.[22] Even so, the rationale of secondary technical education, especially with regard to its relationship with tertiary education, remained elusive. The assessor of the committee, David Ayerst, suggested that a 'unifying theme' for this area of discussion was still missing. He noted that the idea of 'a technical age and mechanically-interested boys and girls' had been 'prominent in all our discussions', but that it failed to provide a precise and coherent rationale for secondary technical education.[23] Crowther, however, suggested a fruitful approach to this problem. He argued that rather than looking for ways in which technical education might be based upon and oriented towards employment and industrial needs, the committee should formulate an *educational* rationale for the 'practical route'. He proposed, indeed, that …

> 'the whole of this area should be gradually transformed from being primarily designed to meet industry's needs (with some education thrown in) to being primarily designed to continue the education of a large slice of the nation's boys and girls (without destroying the usefulness to industry of the present system)'.[24]

This emphasis upon educational as opposed to vocational and industrial needs was vividly reflected in the final Report, and was most helpful in formulating a general account of the 'alternative road'.

The outcome of the Crowther committee's discussions on the 'practical route' was contained in Part Six of the Report, entitled 'Technical Challenge and Educational Response'. This explored the 'varied collection of plans for vocational training' which constituted further education, and proposed that it should be transformed into 'a coherent national system of practical education'.[25] It calculated that only one in eight young people of between sixteen and eighteen were continuing in full-time education, and recommended that this proportion should be increased to 50 per cent within twenty years. It also contended that those young people who left school at fifteen but continued in some form of further education — about one-quarter of the age-group — should be encouraged to remain at school to prepare for entry into a technical college. This would entail the creation of 'a greater degree of integration' between the schools and further education than was currently the case. It would also involve the formulation of a clear rationale for technical education which was able to embrace activities in both schools and technical colleges.

The final chapter of Part Six, chapter 35 of the Report as a whole, was entitled 'The Alternative Road', and this attempted to outline the nature and implications of the 'practical approach' in education. It stressed that not all pupils were attracted or motivated by 'the academic tradition which inspires and is embodied in our grammar schools and universities'.[26] There were, indeed, 'two kinds of minds' which should be approached in different ways.[27] The first kind of mind was the academic type, 'which is readily attuned to abstract thinking and can comprehend the meaning of a generalisation'.[28] These were best catered for by grammar school education. However, '... there are other minds which cannot grasp the general except by way of the particular, which cannot understand what is meant by the rule until they have observed the examples'.[29] Such minds, which 'move more easily from the practice to the theory', or which 'reason better in non-verbal ways', were 'not necessarily inferior', and more provision should be made for them.[30] In the past, the only alternatives for most boys and girls at the age of fifteen or sixteen had been 'the full-time academic route, for which they may not be suitable and which may not attract them', and 'the part-time route, which, for all its merits, has the disadvantages of requiring a prior entry into the labour market, of being rather narrowly vocational, of being very arduous, and of not being available at all to many boys and most girls'. The Report argued that a major task of English education was 'to construct a new system of education for the years between 15 or 16 and 18 which would neither suffer from these defects of the part-time route nor be academic in the old conventional sense'.[31] This new system would involve 'practical' education, but would not be narrowly technical or vocational. It would be intended to provide 'the widest range of instruction for young people who will be proceeding into a great variety of different employments'. Above all, however, 'If the country is to benefit fully from the intelligence of all its able boys and girls, it will be necessary to rehabilitate the word "practical" in educational circles — it is often used in a pejorative sense — and to define it more clearly.'[32] This alternative approach might be fostered in the schools, Crowther suggested, by encouraging the secondary technical schools, some of which had already been able to develop 'a practical education making progressively exacting intellectual demands'.[33] But the Report acknowledged that such education, marked by a 'broad scientific curiosity' rather than by 'narrow vocational interest',[34] was only in its 'early stages of development', and so it recommended that further inquiry should be made into the problems associated with the general notion of the 'alternative road'.[35]

The conception of the 'alternative road' developed and recommended by the Crowther committee certainly contrasted with the traditional academic approach of the grammar schools. However, it was broad and 'liberal' in its account of practical education, and sought an educational more than a vocational rationale for its development. It may be added that in its analysis of 'different types of mind' the Report leaned heavily upon the prescriptions of the Norwood report of 1943.[36] Lawrence Stenhouse, in a stimulating early essay, noted that Crowther's 'alternative road' was still 'not open to traffic', and that when it was opened it would still be 'narrow and selective'. For the lower streams in the secondary modern schools, Stenhouse pungently observed, 'there is no choice of road to confuse us: we are still trying to make these pupils roadworthy'.[37] Crowther's acceptance of 'tripartite' divisions in education is an important point which must not be overlooked when we come to assess the Report's general significance. For the moment, let us examine the influence of the Crowther report's advocacy of the 'alternative road'.

Crowther himself was disappointed at the lack of practical response to this section of his Report. The House of Commons debated the Report on 21 March 1960, and Eccles, on behalf of the Government, was warm in his praise.[38] However, in a careful speech, he did not commit the Government to carry out its proposals. This was probably in part because of the financial implications of its recommendations. The annual cost of education in England and Wales had already grown from £280 million to £700 million in the last ten years, and the Crowther report estimated that the cost of its own proposals would be another 200 to 250 million pounds a year. The Government had already committed itself to a large expansion of the technical colleges, and was probably already anticipating the further expansion of the university system. Also, Eccles seems to have been less enthusiastic about the secondary technical schools as independent institutions than was the Crowther committee, and may have felt that their future as an element in the 'alternative road' was somewhat limited. Particularly in view of the fact that a general election had only recently been completed, the Government may well have decided to wait before making a firm decision regarding educational priorities and planning.

The *TES* was quick to condemn the mixture of 'vague assurances and pious hopes' offered by Eccles in the House of Commons debate, concluding: 'The Government have looked at the Crowther Report and have decided to do nothing about it .... When the history of our present education comes to be written it will surely be seen that with chances unseized and opportunities lost Monday was its sorriest day.'[39] Crowther was less scathing, but also expected little: 'It is at least very gratifying to know that the Minister accepts the report in principle — though I have lived long enough to be a little sceptical about what it means when a Government accepts a report in principle and leaves it to future circumstances to decide when and how it will be put into practice.'[40] However, he did allow himself to express his 'keen disappointment' at the lack of interest in the sections devoted to technical education: 'here is the biggest gap in English education, and by the same token the most exciting opportunity, and nobody is interested.'[41] Even so, over the following decade the notion of the 'alternative road' put forward by the Crowther report did have an important effect upon efforts to 'rehabilitate the practical', especially at the school level.

Perhaps the most obvious of the Crowther report's long-term effects in this area was its contribution to the creation of the Schools Council Project in Technology which was launched in 1967. In one sense, its role in this was quite accidental. Sir David Eccles, in the House of Commons debate on the Crowther report in March 1960, observed that the Report's findings on sixth-forms were 'an irresistible invitation for a sally into the secret garden of the curriculum'. The location of responsibility for curriculum change was most uncertain in the post-war years. LEAs generally confined their active role to the organization of secondary education as a whole, and varied widely in their attitudes even on this. Schools were ostensibly left to their own devices, although the pressures of examinations, universities, parents and other considerations acted as powerful constraints. The result was a 'vacuum' in the control of the school curriculum which inhibited its development.[42] One minister of education, George Tomlinson, is said to have remarked that 'Minister knows nowt about curriculum.'[43] However, Eccles was now moved to argue that such 'reticence' had been 'overdone'. Although — of course — 'Parliament would never attempt to dictate the curriculum', he promised to 'try in the future to make the Ministry's own voice heard rather more often, more positively, and no doubt, sometimes more controversially'.[44] Two years later, Eccles announced the formation of a new 'Curriculum Study Group' within the Ministry.[45] This new unit provoked opposition from LEAs and teachers' associations, but it was still argued that there existed 'a vacuum in curriculum matters which is becoming urgent to fill'.[46] The Curriculum Study Group was replaced in 1964 by the Schools Council for the Curriculum and Examinations, which gave an important role to LEAs and majorities on most committees to teachers' unions; and it was the Schools Council which established first a pilot development project and then a major project costing £180,000 over three years, both to be led by Geoffrey Harrison of Loughborough Training College.

Thus, the process by which a national project concerned with school technology arose from the Crowther report was in a sense somewhat circuitous. At the same time, however, the notion of the 'alternative road' as propounded by Crowther had a direct and profound influence upon the outlook and aims of the Schools Council project. The idea of the 'alternative road' was immediately seized upon by the Association of Heads of Secondary Technical Schools (AHSTS) to explain the approach adopted by these schools and to plead for their retention as independent institutions. In particular, Edward Semper, the head of Doncaster Technical High School for Boys and a leading figure in the Association, sensed a vital opportunity to clarify this approach and press for further publicity. Semper was quick to take up the Crowther report's suggestion that a further inquiry should be made into the meaning and implications of the 'practical approach'.[47] At the annual conference of the AHSTS held in Doncaster in 1961, the technical school heads called unanimously for the minister of education to appoint another committee on the 'alternative road',[48] and Semper thereupon decided to organize his own curriculum research project on this theme. A small development committee was set up under the chairmanship of Professor Boris Ford of the University of Sheffield, with Semper acting as secretary. Private foundations showed little interest in financing a national research project in this area, but the joint secretaries of the new Schools Council offered to take over the whole project under their own auspices.[49] The development committee handed over the project, which ultimately evolved into Harrison's 'Project Technology'.

The creation of 'Project Technology' was also influenced by a report compiled by Graham Page of the Institution of Mechanical Engineers, published in 1965, which emphasized the importance of the idea of the 'alternative road' in encouraging applied science and technology in schools. Page discovered that in grammar and public schools where applied science and technology were regarded as an integral part of science teaching, the idea of the 'alternative road' constituted a major rationale. Indeed, it was found that 'The case for applied science activities in schools leaned heavily on the case for the "alternative road".'[50] However, the *sine qua non* for such activities was the 'almost missionary fervour' of individual teachers.[51] It was noted that 'in the past, research in education has been sparse, uncoordinated, and by the grace of people like the Nuffield Foundation'. Therefore, 'school applied science activities have leaned heavily on the meagrely supported efforts of a small band of enthusiasts'.[52] What was needed now, Page concluded, was 'a central agency as the recognised focal point for the dissemination and sharing of information between schools and between industry and the schools'.[53] This was what the Schools Council now aimed to provide in the shape of its project in technology.

The leaders of the Schools Council project were apparently aware of their debt to the Crowther report's conception of the 'alternative road'. Donald Porter, a craft inspector who was a key figure in the creation of the project, was strongly influenced by the general notion. He wrote a curriculum bulletin entitled *A School Approach to Technology* which was published by the Schools Council, in an attempt to build upon the ideas put forward by Crowther.[54] Porter noted that since the secondary technical schools had by now all but disappeared because of the introduction of new schemes of reorganization on comprehensive lines, 'if the "alternative road" is to survive ... it must be found a place at the appropriate stage in all secondary schools'.[55] The organizer of the project, Geoffrey Harrison, also acknowledged the influence of the Crowther concept. He later remarked that

> 'The Alternative Road of the Crowther Report suggests the best approach, for many students, might be from application to fundamentals

> rather than vice versa. This order also coincides with what is frequently the order of thought of the engineer who may find himself using accepted techniques which are known to work, without fully understanding the fundamental scientific principles behind them. Indeed it is often necessary to use these techniques in order, ultimately, to understand the fundamentals.'[56]

Some other attempts to encourage applied science and technology in schools were also influenced by this view that topics could be approached by tackling particular applications in order to understand the general principles behind them. The Duke of Edinburgh, a highly prominent advocate of greater recognition for applied science and technology in schools, argued that teachers should 'Work from the motor car to the physical laws and from soap to the chemical laws.'[57] Sir Joseph Pope, formerly professor of mechanical engineering at Nottingham University, claims never to have read the Crowther report but adopts precisely this view; 'You should play with an electric motor, and begin to wonder why the hell it works, and then you'll be interested and be willing to learn electro-magnetism.'[58] Other would-be reformers did not go so far as this, but agreed that an alternative to the traditional grammar school science tradition needed to be found. For example, Gerd Sommerhoff of Sevenoaks School in Kent argued that 'traditional school science' dealt only with 'the analytical function of science', and he established a 'technical activities centre' within the school to encourage an intellectual and practical appreciation of the applications of science.[59] Meanwhile G.C. Sneed, head of applied science at Ealing Grammar School, developed an applied science course which also attracted widespread attention. He claimed that 'we are the only grammar school in the country which has created a special course whose aim is to try and persuade able boys in the science-sixth to take engineering degrees at the university'. The course at Ealing included the study of fluid flow, heat engines, strength of materials and electronics, and made it possible not only to 'teach the mathematical principles', but also to 'allow boys to carry out useful practical work'.[60] The Duke of Edinburgh, Semper and Harrison may be taken as having advocated a 'strong' or 'hard-line' version of the 'alternative road' in insisting that school science teaching need not begin with theoretical principles, but could usefully proceed from particular applications. Such reformers as Sneed and Sommerhoff, meanwhile, favoured a 'weak' or 'soft-line' version of the 'alternative road' because they continued to stress intellectual rigour as a basis for 'useful practical work'. There was some tension between these 'strong' and 'weak' versions of the 'alternative road', and the distinction remains an important one. One recent echo of this debate was provided by a discussion between Frank McKim of Marlborough College and Tom Dodd of the Association of Advisers in Design and Technical Studies. McKim argued that 'there should be at least a component of technology or applied science in what we school teachers teach and what is examined'; to which Dodd replied: 'I wonder if I could question a basic assumption of Dr McKim that the main route to technological understanding for many pupils is through science? Might there perhaps be a route the other way round, through technology to an understanding of science and a scientific body of knowledge?'[61] It was clear that while the most intrepid were willing to risk the hazards of the high road, others, equally committed to change, preferred to take the low road. However, in an important sense they all tended to end up where they had started, in individual schools with exceptional teachers and circumstances which were not readily transplanted.

It seems likely, indeed, that if the notion of the 'alternative road' influenced these various initiatives of the 1960s, the persistent ambiguities and problems associated with the notion help to explain the disappointing impact of the initiatives. The practical implications of the 'alternative road' in curriculum terms were never fully worked out. The Crowther committee itself acknowledged that further enquiry was needed into the 'practical' approach in education. Very few secondary technical schools lived up to the ideals expressed by the Crowther report. Semper admitted not only that 'we have scarcely begun to develop a practical approach to education in our schools', but also that the 'alternative road' would 'remain a pipe dream' unless prompt action were taken 'to stimulate enquiry and foster research into the many problems associated with it'.[62] The development committee established by Semper failed to clarify the implications of the 'alternative road', and was divided on important points of emphasis and opinion. For instance, George Bosworth was alienated by Semper's increasing preoccupation with 'creativity' and 'problem-solving'. He saw such topics as an 'intellectual cul-de-sac', complaining that creativity was rather 'airy-fairy' and 'impossible to communicate'.[63] The Schools Council project in technology was plagued by such differences, and indeed was strongly criticized even by such figures as Semper and the Duke of Edinburgh. Harrison later acknowledged that the Schools Council project had been beset with pressures from all directions, and that the word 'technology' retains an 'awkward ambiguity' even in the 1980s.[64] The Action Group and the Schools Science and Technology Committee, which were created partly because of dissatisfaction over the outlook of the Schools Council project, themselves failed to formulate a coherent and effective vision of the 'alternative road'. The Standing Conference on Schools' Science and Technology, founded in 1971, continued to be surrounded by differing interpretations and tensions on the nature of the 'practical approach' in education.[65]

One important lesson of all this appears to be that if the 'practical' still requires 'rehabilitation', as it did in 1959, it is also no less in need of elucidation than it was all those years ago. The notion of an 'alternative road' in a sense helped to evade this problem of definition. It was a broad, all-embracing conception which permitted varying emphases and interpretations, and 'strong' and 'weak' versions of its central theme, and this meant that it could be invoked to support differing and even conflicting approaches to the introduction of applied science and technology in schools. It was a slogan which provided not one 'practical' approach in education, but legitimation for various 'practical' approaches in education. Its supporters had in common a dissatisfaction with traditional grammar school education, and a desire to 'rehabilitate the practical' within secondary education; but they were as divided as ever when it came to positive proposals for action.

The contrast between different notions of 'practical education' may be highlighted by comparing the Crowther concept with the original rationale of the Technical and Vocational Education Initiative (TVEI), launched in November 1982. The Crowther report attempted to combine 'academic' and 'practical' aims in its notion of the 'alternative road', to give 'a practical education making progressively exacting intellectual demands'.[66] It was based more upon an educational rationale than upon vocational and industrial aims. By contrast, the TVEI was controlled by the Manpower Services Commission, which was accountable to the Department of Employment. David Young, the chairman of the MSC, stressed the improved employment prospects which the TVEI could offer: 'By the time they leave our youngsters will be highly employable.'[67] In 1963, Edward Semper, aiming for wider educational appeal, had suggested changing the name of his Association to avoid 'technical' or 'vocational' connotations in favour of 'an adjective suggesting "purposeful", "creative", "inventive" or "imaginative"'.[68] The Council of the AHSTS was sympathetic to this view, remarking that 'an alternative to "Technical" or "Vocational" in the name was needed because the connotation of these words was debased'.[69] Yet in 1982, a new venture in 'practical' education, with full government support, went out of its way to proclaim its 'technical' and 'vocational' character. It may be that one of these approaches is more valid or effective than the other, but the contrast between them demonstrates above all else the persistent ambiguity of the term 'practical education'. When this ambiguity is forgotten, it is often tempting to argue that Britain's relative national decline has been due to a failure to adopt the 'practical approach'.[70] However, in view of the incoherence of the 'alternative road', such analyses appear to be no more than wishful thinking.

It is also apparent that one vital aspect of the Crowther concept was often neglected in the initiatives of the 1960s. The AHSTS, the Schools Council project and the various other attempts to 'rehabilitate the practical' were preoccupied with finding new methods and approaches to topics which would encourage their introduction in schools. This meant that they put much less emphasis upon the idea of the 'practical route' from schools to further education, which was just as important an element in the Crowther concept as was the idea of the 'practical approach'. It is true that several such reformers sought to foster a closer relationship between education and industry. George Bosworth felt that the creation of an 'alternative road' in education would entail the establishment of a 'matching section' between education and employment, 'designed to ensure the efficient conversion of the university graduate into an effective industrial technologist, and which will attract a higher proportion of the ablest graduates into industry'.[71] Semper's development committee and the Schools Council technology project both attracted support and representation from industrial concerns. However, there was a strong tendency to seek respectability for applied science and technology by appealing to grammar schools, acquiring academic examinations and aspiring to university entry. Initiatives to follow up the Crowther concept became increasingly divorced from further education, and even the new polytechnics. Some advocates of the 'alternative road' at the school level feared that close association with technical colleges might damage their cause. Indeed, one study which inquired into the reasons for the low esteem in which technology was held among sixth-formers, concluded that: 'technology is too easily associated in students' minds with the technical college route. Since the technical college is ascribed second class status technology must follow suit!'[72] George Bosworth, who himself became head of Newcastle upon Tyne Polytechnic, finally conceded that 'Anything other than the university route was always going to be the poor man's route'.[73] In order to 'break down the popular misconception that an engineer is someone in a boiler suit with greasy hands',[74] Crowther's 'practical route' was studiously avoided.

In general, then, the aims of the Crowther report with regard to the 'alternative road' have still to be realized. It is clear that Crowther failed to develop the implications of his argument; also that the report was strongly influenced by an old-fashioned 'tripartism' which is surely unacceptable today. Even so, detailed reference to the arguments of the Crowther report may be of value in addressing current educational problems. In some ways, the situation has changed little since 1959. Crowther argued that it was necessary 'to rehabilitate the word "practical" in educational circles', and this is still needed. He aimed to encourage the transformation of 'a varied collection of plans for vocational training into a coherent system of practical education'; today the collection of plans for vocational training is more varied than ever. The Crowther report also suggested that 'a practical education making progressively exacting intellectual demands', marked by 'broad scientific curiosity' rather than 'narrow vocational interest', should be developed and elucidated, and this has still not been accomplished. Indeed, greater attention to the principles outlined by the Crowther report might provide a useful corrective to the 'vocationalism' of the TVEI and current youth training schemes. The 'alternative road' was proposed as an alternative 'to both the merely theoretical and the rather narrowly technical'.[75] Those political parties, interest groups and teachers who are critical of the approach underlying present schemes could do worse than pursue this line of thinking. Supporters of comprehensive schools may be alienated by the 'tripartite' basis of the Crowther report, and justifiably so, but the same report offers important clues towards the formulation of a liberal antidote to current vocational prescriptions — a conception of 'practical education' which places greater stress upon educational values than upon industrial and vocational aims. This emphasis is perhaps especially relevant to the new conditions which will be created by the 'microelectronics revolution' in industry and society. A transformation of work and leisure patterns for the large majority of the population will surely lead to profound changes in the nature and justification of education. More particularly, assuming that 'practical' education will still be required in a post-industrial society, it will presumably not be oriented to the needs of industry and work as currently understood. In such a situation, the 'practical' may well be 'primarily designed to continue the education of a large slice of the nation's boys and girls', rather than 'being primarily designed to meet industry's needs (with some education thrown in)'.[76] The Crowther concept, neglected, distorted and frustrated in its own time, could yet prove to be a harbinger of the future.

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Part Two
PRACTICAL RESPONSES

6
Technology in Schools

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PREAMBLE

After the discussions of the previous two days I felt it was necessary to go back to my copy of the Crowther Report and to study the context of the title of this Conference. To my concern I discovered that the title was, in fact, a rather serious misquotation! Chapter 35 of Crowther refers to 'the rehabilitation of the *word* practical', it did not say rehabilitate the practical. I think this is a very significant difference.

The word practical, itself, does not need rehabilitating; it is what it refers to that is important, and the Crowther Report refers to several aspects of practical education which certainly need to be elucidated and given more importance and prominence. I am afraid that these areas of practical education cannot be 'rehabilitated' because they never were recognized, or at least not for very many years. If we go back to the end of the sixteenth century we find that Francis Bacon, in developing his ideas about the advancement of learning, said, 'it is a dishonour unto learning to descend to matters mechanical'. In other words, the practical certainly was not given high status in those days; but despite its low status, Bacon himself gave it a very high level of importance and in referring to what he calls his four intellectual arts, he put 'invention' at the very top of the list, far ahead of mere memory and possession of knowledge. But he did not see that it stood on its own. In fact, he went so far as to say that 'separation [i.e. separation of invention from memory] perverts rather than disciplines the mind'. So you see it is not so much a matter of rehabilitating practical education; it has never received the status that many people, including Bacon and Crowther, thought to be important over the centuries.

However, I do believe that it is time that practical education was not so much developed into new fields as articulated in a more positive way in the literature of education. Equally, it needs to be seen as having status comparable with that of the purely intellectual. It is interesting to observe that, for instance, while the armed forces of the country are very concerned about technical education, and much of their educational training is of a highly vocational and practical kind, nevertheless, when the Navy seeks to recruit artificers, the kind of people they are looking for are those which the engineering professions are also looking for. They are not, however, prepared to offer them Officer status.

INTRODUCTION

My brief for today has been to review the developments of technological curriculum development during the years since the second world war. In particular, I am going to look at the origin and purposes of Project Technology, which was one of the major Schools Council curriculum development initiatives in the '60s. Its strategies and projections I will set against a number of issues which were found necessary to be resolved. I will then go on to the current state of play of technological educational development, with some inferences into the future. I will be tackling this looking essentially at the 1960s with the advantage of my point of view being that of the 1980s.

THE ORIGINS OF PROJECT TECHNOLOGY

There were many influences which brought about this major investment by the Schools Council in the mid-1960s. Edward Semper and the Association for Technological Education in Schools had been developing pilot proposals for such an initiative for several years and had indeed received promises of support from British industry. The Institution of Mechanical Engineers had been concerned about the status of engineers and the recruitment and supply of engineers, which did not appear to be meeting the needs of British industry. They commissioned Terry Page, of the journal *Engineering*, to conduct a survey of what was going on in the schools by way of engineering, and through discussion with all interested parties, to bring forward proposals for further development work. Donald Hutchings of the Department of Educational Studies at the University of Oxford had recently conducted a survey of technology in the school sixth forms (*Technology and the Sixth Form Boy*), and amongst the many findings from that report he pointed out that of those boys who were taking Mathematics and Science in the Sixth Form, those who did best at 'A' level tended to be the ones who were going into Pure Science, and those who did second best were the ones who went into Applied Science and into Engineering.

In addition to these studies the Government of the day had already established what was known as the Interdepartmental Working Party on Publicity for Engineering and Technology, and this was concerned with studies and recruitment through films, conferences, exhibitions etc which would encourage the flow of able young people into the engineering professions.

There were also current at that time, the studies of the Manpower Committees of the Department of Education and Science and Ministry of Technology. Amongst these was the famous Dainton Report, which made some very specific recommendations about ways in which Science and Technological Education might develop in schools so as to encourage the recruitment of people with the right kinds of ability into science and engineering.

However, quite apart from all these national and institutional developments, there were very many individual teachers who had been developing technological, technical, engineering and design types of approaches in the schools, for very many years indeed. The trouble was that these were only individual developments and they lacked any kind of national coherence, and this made it very difficult for any expansion to take place. It may be interesting at some stage to conduct more detailed studies of some of these individual developments and how they have bred from each other. For instance, the work of Sanderson at Oundle in the early years of the century must be regarded, I believe, as one of the major signposts and original developments. Many of the ideas at Oundle are still being pursued there to this day, but there have also been spin-offs from Oundle to other schools, to Dauntsey's, to Oakham, and to many others. Apart from the Oundle development, Christ's Hospital School also became famous at the turn of the century for its development of applied approaches in science, and figures like Barnes Wallis attribute much of their own ability to innovate and think originally to the work of their teachers at Christ's Hospital. Throughout this century Sir Graham Savage, initially as a teacher, then as an HMI from 1919 to 1939, and during the war as Education Officer for the London County Council and following this as Assessor to the Committee for the Industrial Fund in the '50s, was conscious of the need for more importance to be attached to practical aspects of education for the most able as well as the less able pupils. He was continually frustrated by attitudes, not only within the education profession itself, but also amongst engineers and others outside teaching who saw the importance of mathematics and pure science as being paramount and application of knowledge as having no significance.

I myself, having been appointed first to direct the Pilot Study and then the main Technological Project for the Schools Council, was conscious, even at the time, of the debt I owed to my own school and its connections with Oundle. I was at Dauntsey's School, both as a boy and as a member of staff, and we had been expected, as boys, to be very active in self-help in the technical sense, from the levelling of playing fields to the building of pavilions, and the construction of school furniture. Similarly, when I was the Engineering Master at the school, we found it necessary (and desirable) to get the boys to build our own Engineering Block if we were to develop any kind of engineering approach in the curriculum itself.

It will be interesting, at some stage, to know in more detail just how decisions were made and how the method of making them has changed, within the Schools Council during its lifetime. It would appear that in the early days of the Council, while committees were still establishing their own power base, there was plenty of scope for initiatives to be taken and implemented by the Officers of the Council, and this, it seems, is what happened in the case of Project Technology.

Edward Semper had put forward the proposal that there should be a project for development in Applied Sciences in the Sixth Forms, and when Harold Wilson came to power in 1964 Semper wrote to the Government proposing this initiative. Not achieving any response he wrote to Wilson directly, and he, being very concerned at the time with the white-hot heat of the technological revolution, sought out what had happened to the proposal. On finding where it had got to, he passed it to the Schools Council, which had just been set up with responsibility for taking curriculum initiatives, and it was from there that the Council started to develop ideas about some form of technological project. Whether the idea would have arisen spontaneously is problematical. The outcome, anyway, was that I was asked at the end of 1965 to undertake a pilot study in the academic year '66–67, to look at what teachers, who felt that perhaps some form of technological input to their teaching would be desirable, actually wanted to do and what kind of support they felt was needed.

The report of my small team was published as Working Paper 18, *Technology in the School*, by the Schools Council early in 1968. It came to the conclusion that two developments were required. The first was the preparation of supporting teaching materials and their testing and publication. The second was for the development of support external to the schools which would have a positive effect in encouraging technological changes to take place in the curriculum. Without either of these the other would be of little impact. I remember reporting to the Schools Council, towards the end of our pilot year and after we had been discussing with teachers and others around the country not only what was needed but what the problems would be in getting technological elements established in the curriculum, that our deliberations suggested that it would take forty years for the various parts of the Education Service to become sufficiently coherent and effective in the technological direction for there to be a significant change in the school curricula on a national scale. In the years since that time, in 1967, I have had little reason to modify that forecast. It is only this year (1983) that any suggestion has come forward that that might be a conservative expectation. The developments of the Manpower Services Commission during the present year certainly suggest that a forty-year development is perhaps being a bit too pessimistic.

GENERALIZABLE ISSUES

I now want to talk about a number of issues which, although they have been specific to Project Technology and technological developments since the mid

'60s, might well have a generalizable bearing on other curriculum initiatives in the practical field. These issues I will look at from the point of view of the 1960s and 1980s and in anticipation of the longer-term picture. The issues that I wish to consider are:

the power bases from which curriculum initiatives stem and on which they become consolidated;
the educational purposes and philosophies of education developments;
the elucidation of a generally acceptable definition of technology and of the pedagogical aspects of teaching in relation to technology;
the influences and support felt by the schools; and
the stabilizing factors which are inherent within the educational service.

Power Bases

It is very noticeable how the power wielded by the different parts of the education service has changed from the '60s to the '80s, and it is reasonable to expect that similar changes will continue into the '90s. For instance, the Schools Council became a very powerful base in the late '60s and early '70s, but has now been replaced. The power that was wielded within the Schools Council developed from being in the hands of the officers to becoming more wholly based in the union-dominated committees and this has had a curious effect on the Council's ability to influence the school curriculum.

Neither the Department of Education and Science, nor the Ministry of Technology, in the '60s, were able to do anything in real support of technical education, even if they had wanted to do, which is questionable. It was in 1969 that Project Technology, together with the Duke of Edinburgh's School Science and Technology Committee, took forward proposals jointly to DES and MinTech for a major development in technological education. While both departments gave it their blessing there was just no way in which they were able to take any initiative to actively support it with cash.

HMI, at that time, were equally passive, despite the initiatives of individuals such as D I R Porter, Staff Inspector for Handicrafts, who had been able to achieve secondment from his post in the mid-'60s, and published, through the Schools Council, his *A School Approach to Technology*.

By the 1980s the fortunes of the Schools Council had sunk and very little power was available from there for developing technological education. On the other hand, HMI, working within DES, had become much more influential and articulate about what they felt to be appropriate forms of content for a number of subject areas of the curriculum. Publication of *Curriculum 11–16* at the end of 1977 and more updated versions of parts of it in 1983, together with publications about science education and the primary and secondary surveys gave the Inspectorate active, rather than passive, influence over what was going on in the school curriculum. In a rather different way the Department of Industry more recently acquired, by Act of Parliament, authority to spend money in direct support of certain areas of the school curriculum, particularly those to do with industry. As a result, working with a number of agencies such as the National Centre for School Technology and the Standing Conference on School Science and Technology, many hundreds of thousands of pounds annually are currently being spent in support of technological education. These are some of the ways in which the sources of power for technological education are changing. The most obvious one, which we have now in front of us, is that of the Manpower Services Commission and the new Technical and Vocational Education Initiative, which is poised to be highly influential with very substantial sums of money available in the development of practical education in the schools.

In addition to the power bases resting on finance and vested in central institutions, I believe that in the longer term, going on into the '90s, practical education will have become more self-supporting. There is a general recognition of its value and a general recognition of the forms of practical education which have been developing over the last two decades. This itself will provide its own power base and it is reasonable to suggest that developments will not take as long as our original forty-year estimate. This may be optimistic, but I believe it is a reasonably objective view of the future.

Educational Purposes and Philosophy

The second generalizable issue is that of educational purpose. Schools Council *Working Paper 18*, on which Project Technology was based, set the purpose of the project as being to help all children to get to grips with technology, as an influence on them and on society, but the support for this overall purpose came from sometimes contradictory directions. On the one hand, there was the industrial lobby which suggested that more children should become better qualified and better motivated to seek careers in industrial employment, while on the other hand, there were the interests of general education which were saying that education for a society which was so powerfully influenced by technology should itself be strongly influenced by technology and have technological dimensions. But at that time, in the 1960s, that was about as far as it had got. Something needed to be done and there was a need for supporting teaching material and a need for external support. I felt, at the time, and as an ex-engineer, that that analysis of the situation was fairly well based on an engineering type of analysis of what needed to be done and what the procedures should be. It is interesting to note, however, that those whose profession it seems to be to analyse curriculum development programmes use the notion of an engineering model for something quite different. Now is not the moment to expand on that point.

More recently, that is, into the 1980s, the purposes of technological education have become more directly educational. With rising unemployment it is not so easy to argue that we need more engineers and technicians in industry. It is all the easier, however, to argue that our children should become technologically aware, competent in the skills of technology and capable of tackling whole technological problems. Prime Minister Callaghan's

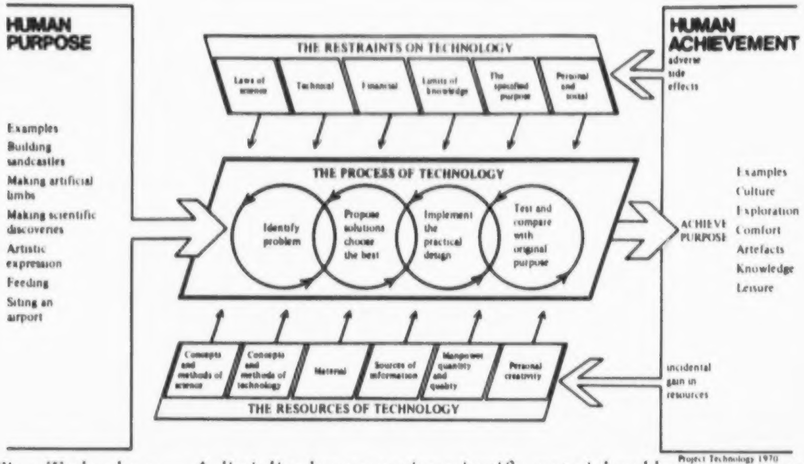
Ruskin College speech was one of the first signs that this kind of educational purpose was being recognized at the highest Government levels. It is reasonable to assume, I think, that the development of educational purposes in relation to technology has moved from a doubtful area where the needs of industry were considered to be paramount, to the stage where more pure educational aims have become acceptable. The two sides of the dichotomy have become wholly compatible. The Manpower Services initiatives, while not in any sense leading on educational method, do make it quite clear that we will be needing, in this country, a population that is able to fend for itself, is able to earn its own living, and is technologically capable and competent. At the same time, there has developed in the schools a sense of educational purpose which complements this precisely, and conflict between the two has ceased to be a major issue, whereas in the '60s headteachers were tending to say, 'if anybody tries to make me produce more "industry fodder" it will be over my dead body'.

Elucidation and Explanation

The third generalizable issue is that of elucidation and explanation of a number of matters, including an acceptable definition of technology itself, and an acceptable statement of the pedagogy of technological education.

Project Technology spent a great deal of time in discussion with teachers and others in attempting to bring about an acceptable definition of technology for the purposes of education. On the one hand, there was a tendency to use technology in the sense of 'chemical technology', 'communications technology', 'computer technology', 'video technology', etc and these were regarded as the specific technologies. On the other hand there was the tendency to use the word technology in expressions such as 'the impact of technology on society'. It was felt that these were very loose uses of the word and if there were to be educational development with a sound philosophical basis it would be necessary to find something a bit more specific. What the Project pointed out was that technology was a process, a disciplined process of using material, human and scientific resources to achieve human purpose. The model which was developed then, shown in Figure 1, has been in use ever since.

It is interesting to observe that this model has been accepted in virtually unaltered form as the base model for a number of educational developments, not only in England, but in Scotland and in a good number of overseas countries. There were three particular points about this model which it is worth emphasizing. First of all there was the notion of technology itself being a process, the process of identifying problems, creating solutions, testing the solutions, and continuing into further problem solving. Then there was the connection between this process and human purpose and achievement. In other words technology should not be seen as being a nuts and bolts exercise for its own sake. And thirdly, there was the notion that in order to engage in this process, a number of resources needed to be called upon, including those of knowledge and of intellectual and physical skills. In educational terms, this means that science and mathematics etc as a potential resource would have to be in a form which would be usable for application in the technological process. In the 1960s there had been no such statement of technology and practical education was seeking some form of acceptable understanding. In the 1980s we have evidence that this model is beginning to be in more general use, and the fact that it seems to have stood the test of time suggests that it could go on being the model for technological education for some time to come. In other words, the meaning of technology *has* been elucidated to the point of general acceptability. Despite this, some people will still feel it needs elucidation.


HUMAN PURPOSE
Examples
Building sandcastles
Making artificial limbs
Making scientific discoveries
Artistic expression
Feeding
Siting an airport
THE RESTRAINTS ON TECHNOLOGY
Laws of science
Technical
Financial
Limits of knowledge
The specified purpose
Personal and social
HUMAN ACHIEVEMENT
adverse side effects
THE PROCESS OF TECHNOLOGY
Identify problem
Propose solutions choose the best
Implement the practical design
Test and compare with original purpose
ACHIEVE PURPOSE
Examples
Culture
Exploration
Comfort
Artefacts
Knowledge
Leisure
Concepts and methods of science
Concepts and methods of technology
Material
Sources of information
Manpower quantity and quality
Personal creativity
incidental gain in resources
THE RESOURCES OF TECHNOLOGY

Project Technology 1970

Fig1. Technology — A disciplined process using scientific, material and human resources to achieve human purpose.

What also needed to be elucidated was the pedagogy of technological education. Project Technology, in developing its teaching materials, saw that it was necessary to develop teaching resources to help with the problem solving process of technology, with making knowledge and skills usable, and with awakening a social awareness of the impact of technology. These three aspects of technological education were at the heart of the developments in the days of the Project, and they still seem to be with us. They have appeared again in the modular courses in technology and I would refer you to the findings of the Finniston Committee, which referred to the engineering dimension and to my own Stanley Lecture on *The British Technic*, which laid out a pattern of curriculum analysis based on capability, awareness and resources.

In addition to this breakdown of aspects of technological education, it was also accepted that there was a variety of ways in which technology could be included in the school curriculum. First there was the idea that there were many subjects which could be enriched with the technological dimension and this could possibly go right across the school curriculum. Secondly, there was a call for courses which were structured, quite categorically, to meet the educational objectives of technology. Control Technology, Modular Courses in Technology etc were examples of such developments. Among them was the idea of general studies being used to make children more generally aware of the impact of technology on society. Some schools have used all these, while others concentrate on one rather than another. Each of them, however, is able to lay out a firm basis of objectives and methods based on a common understanding of technology.

Influences on the School Curriculum

Another issue which might be generalizable from the specific examples of technology is that of the forms of influence that exist on the school curriculum. On the one hand, there is the idea of local autonomy and the total decentralization of English education. On the other hand, as mentioned earlier, there is an increasing degree of centralism and the DES has, for several years now, been expressing its wish to have a greater say in what goes on within the schools. This shift from the vagaries of local autonomy to the consistency of centralism is quite positive and deliberate. If I may quote from the famous yellow book which preceded the Ruskin College speech and was an internal statement of the DES which expressed its ambitions (this should be compared with Sir Graham Savage's long-standing battles to cope with the almost total lack of power of HMI):

> 'It will also be good to get on record from Ministers and in particular the Prime Minister, an authoritative pronouncement on the division of responsibility for what goes on in school suggesting that the Department should give a firmer lead.'

In parallel with these political influences on schools are the industrial interface and the Further and Higher Education interface. In the 1960s, industry, although it was making noises about the inadequacy of the education service, was almost incapable of saying what it actually wanted from the service. Now, following the support from the Department of Industry and the establishment of the Standing Conference on School Science and Technology with its contributing Science and Technology Regional Organisations, there is a much more positive and working link between industry and the school curriculum and particularly on the technological dimension. It is no longer possible for industry to duck the question which seeks guidance from it as to what kinds of qualities and abilities schools should be developing. But that is not to say there is yet a clear understanding in industry of what it is schools are doing. There are many stories which show up this ignorance in industry of the efforts that the schools are making.

The interface with Further and Higher Education is perhaps the most significant one. There has never been a very harmonious relationship between schools and Further Education. There are many reasons for this, including the necessity for institutions to retain a number of students in order that their financial well-being shall be maintained. Even the Hazlegrave Committee in the '60s, which was responsible for setting up the Technician Education Council, recommended that there should be collaborative developments between schools and FE in the development of technician education courses. In fact this did not take place and unilateral developments came about, schools being merely told what kind of entry qualifications would be needed. With the advent of the MSC's Technical and Vocational Education Initiative, there are now many opportunities for a closer link between schools and FE and this could lead to a better matching of successive stages of education.

The other area of influence is that of professional support. Whereas in the 1960s the Institution of Mechanical Engineers and the Manpower Survey Committees of the Engineering Institutions were generally in support of technological education, it was very much in the form of exhortation, not explicit expectation and support. Now, in the 1980s, the professional bodies have a number of organizations which can supply direct support to the schools. There is the Standing Conference on Schools Science and Technology, with its regional organizations. The Conference is itself linked into most of the professional bodies which could have any possible interest in technical education, including the Engineering Council, brought into existence in 1982 following the Finniston Committee, and committed not only to the formation of engineers in the post-school period, but also to the development of the appropriate forms of engineering abilities in addition to those of the pure mathematics and science subjects. It seems reasonable to believe that this shift from exhortation to practical support and expectation will continue. This change is equally coming about in the professional support from within the education service; the recent paper from the Society of Education Officers on *Key Issues for Industry and Education* is a case in point.

Stabilizing Factors

In theory English education is decentralized and every school is able to make up its own mind about the form of its curriculum. In fact there are so many pressures within the system which prevent too much variation that we end up with a remarkably consistent pattern of education. It has been observed that a greater degree of coherence will be found between schools in this country with a decentralized control than will be found in France where, although there is tight control over the curriculum, in fact much variation will be found in schools.

The system of training teachers is itself inherently stable. Those concerned with training teachers are those who have been good teachers, and they will train others in their own image. Teachers come in through the training system having little experience outside education and so change is difficult to bring about. Nevertheless, in recent years there have been some fundamental changes in the training of teachers in the field of Craft, Design and

Technology, and even in Science. Once teachers are trained there is now a greater opportunity for retraining into different fields. The School Teacher Fellowship scheme, organized by the engineering institutions, is one such case, and the recently announced British School Technology In-service Education programme, supported by the Department of Trade and Industry, has brought about a most welcome and massive response from local education authorities, who wish to be involved in the retraining of their teachers towards a more technological approach. However, it has to be recognized that the sheer logistics of training and retraining the large cohort of teachers is a task of enormous magnitude. If there were to be a substantial shift as a result of such retraining, then substantial resources would have to be provided to bring it about.

The provision of books and equipment is another self-stabilizing factor in education. No publisher or equipment manufacturer is likely to invest funds in the development of books and equipment unless there are courses which will call for such resources. On the other hand, it is difficult to develop new courses unless the appropriate books and equipment can be made available. It was for this reason that the Schools Council, the Nuffield Foundation and other curriculum development agencies put resources into the system to bring about simultaneously new courses and new resources. Without that disinterested external funding the laws of the market place will be maintained, with little educational development.

Examinations are another inherently stabilizing factor in education. It has taken the last twenty years, largely since the inception of the Certificate for Secondary Education, to bring about well-developed and widely available new examinations in the technical field. Without these, while it was possible for the individual teacher to develop new examinations, they were not able to become generally available.

Finally, under the heading of stabilizing factors is the essentially academic nature of school disciplines. It is important for teachers, teacher trainers and the professions to have a clearly established discipline to which they relate their activities. The Royal Society's recent paper on *Science in the Secondary School* emphasizes the importance of retaining the integrity of the separate disciplines of science, for example, and this is at the time when many science teachers are trying, for educational reasons, to see virtue in some integrated form of science. But despite the best efforts of Nuffield and the Schools Council the number of students taking any form of integrated science is declining rapidly, while the number taking discrete subjects is building up. The general stabilizing factor is the essential conservatism of academics of any subject towards their discipline.

PROGNOSIS

Taking together all these generalizable issues, it is possible to discern a trend which is reducing the factor of stability within education and is increasing the powers of the central authorities on education. These increasing central powers are developing simultaneously with an increased central concern for a shift in educational thinking to a more practical and relevant curriculum. It is therefore reasonable to take an, albeit subjective, optimistic view of the future. Industry has shifted both its attitudes and its expectations, as well as the nature and magnitude of its provision of support for schools. Even so, for further action, there will need to be close collaboration within industry, the SATROs, other central schemes for bringing about closer collaboration through Understanding British Industry and the Schools Council Industry Project, and the many other effective schemes for promoting school/industry links.

Teacher training has been pared down and the colleges and departments of education are having to look more objectively at their own effectiveness. The imminence of closure of colleges is having remarkable effects on the ways in which lecturers are thinking about their work.

Project Technology proposed a variety of methods of introducing technology into the curriculum. There has been in recent years a degree of coherence in the importance attached to the structured course approach. This itself is being supported by the British School Technology programme and it looks as if this may well be the way in which further developments take place. This is understandable, as teachers appear to be more inclined to shift their ideas if there is something positive onto which they can latch their developments. The recently announced Secondary Science Curriculum Review lays out a wide open field for re-thinking of the curriculum and negotiating subject boundaries, particularly between those subjects involved with science *per se*, and those involved with other aspects of technology.

The availability of equipment and books is significantly different from what it was and there are now no grounds for schools to say the equipment for technology is just not available; it is.

Higher Education is now recognizing the importance of technology. The Council for National Academic Awards and the Standing Conference on University Entrance are taking the problems of entry requirements to engineering courses very seriously and are trying to ensure that proper recognition is given to abilities in the whole breadth of the engineering dimension.

About three-quarters of the local education authorities of England are already expressing a wish to be involved with the British School Technology programme, indicating a very broad spread of local authority support. This itself is illustrated by the recently published paper from the Society of Education Officers on *Key Issues for Industry and Education*.

However, all these developments have been taking place and interacting with each other over the last decade or so, but their effect would have continued to be marginal (at least until the end of the forty-year period!) if it had not been for the Manpower Services Commission and the Technical and Vocational Education Initiative. Many are apprehensive about initiatives, such as this, coming from outside the education service, but in the absence of anything coming from within, what are the grounds for apprehension? Certainly it looks as if the schemes which started in September 1983 have had an enormous amount of educational thought and development put into them. They were not, after all, simply having the Manpower Services Commission's prescriptions for the school curriculum imposed upon them; they were all schemes which had been developed locally by teachers and education authorities. What MSC has done is to provide the money to enable things to actually happen.

So I end on a note of real optimism that the next decade is almost bound to see the rehabilitation of the practical in the sense, at least, of the meaning of the word. I believe it will also see the establishment of the practical as a fully respectable and respected mode of education for all our children and not only those for whom being good with their hands is regarded as second-class.

7

A Comparative View. The Scottish Project 'Education for the Industrial Society'

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THE SCOTTISH EDUCATIONAL HIERARCHY

This paper is about a project that has recently ended, about its achievements and its failures. It will probably be helpful to set the scene by first giving a brief summary of the position with regard to curricular developments and examinations in Scotland.

The Education Act of 1946 gives the responsibility for a school's curriculum to the local authority, with its *de facto* delegation in many respects to a school's head teacher. The education system is administered locally by Regional Education Authorities. The Secretary of State for Scotland, through his Minister for Education and Industry, makes available general guidance both to the Education Authorities and to the school managers. In formulating his views, the Secretary of State certainly listens carefully to Her Majesty's Inspectors of Schools but he also has an independent body, the Consultative Committee on the Curriculum (CCC) for a further source of counsel. It is important to stress that although the Secretary of State consults widely in deciding upon the names of those to whom invitations shall be issued to serve on the CCC, one becomes a member as an individual and not as a representative of any other body. I have been on two successive CCCs and in those seven years it has really worked that way. For example, the Educational Institute for Scotland, the largest teachers' union in Scotland, must have members on the CCC but I could not identify them, by their actions.

Under its terms of reference, the CCC is charged, in the light of social and economic change, with keeping the curriculum under continual review and identifying any aspects which call for special investigation. It has a sub-structure of its own and can therefore, in association with local authorities or independently, sustain a programme of curriculum development based on identified priorities. It makes available to education authorities information and advice of a specific as well as a general nature.

The CCC operates primarily through two main committees, the Committee on Primary Education and the Committee on Secondary Education, COPE and COSE. In the pyramid below these, in secondary education, there are Central Committees which are primarily concerned with subjects or subject groups. Independent of COPE and COSE and reporting direct to the CCC itself are certain Project committees of which the Education for the Industrial Society Project was one. There is also a Curriculum Development Service (SCDS) with directors, curriculum officers, information officers, graphic artists and so on to help the CCC pyramid carry out its curricular work. Based on Dundee, Edinburgh and Glasgow, the SCDS also provides the distribution service for the large amount of resource material that the CCC produces.

The CCC pyramid is shown diagrammatically in the Figure (p 91).

The organization of curricular matters is made more effective by the fact that, in Scotland, there is only one Examination Board, recently renamed the Scottish Examination Board (SEB). The separation of examinations from curricular development irritates some educationalists in Scotland, especially teachers, who often feel that they want control not only of what they teach but of what is examined. As one who is outwith the secondary sector, I see value in an independent examination board, provided there is proper co-operation between CCC and SEB. That collaboration is, in my view, much closer now than it was when I first joined the CCC in 1976.

THE PROJECT

Turning to the Project itself, titled 'Education for the Industrial Society', it was set up in 1977 by the CCC with the wholehearted support of the Minister at that time, the late Mr Frank McElhone. The Project Planning Committee (PPC) was chaired by Dr David White, Rector of Garnock Academy in Kilbirnie. On the PPC were five teachers, including the Chairman, two members of CBI and two of STUC, three from tertiary education, central institutions and universities, and one Chief Advisor from a local authority. There was one HMI and one SED Assessor plus a Field Officer, also an HMI and a Project Co-ordinator, Mr T.K. Robinson, Director of SCDS in Glasgow. This was a very broadly-based group and, over the period it worked together, it developed a remarkably good corporate spirit. The remit of the Project was extremely wide:

> 'To review the arrangements which secondary education and the secondary schools make to prepare pupils for life and work in an industrial society; to consider what changes and innovations might be made in current practices, curricula and courses to make them more effective; to conduct pilot experiments as appropriate; to evaluate the project; to liaise as appropriate with other elements of the CCC's substructure; and to report to the CCC.'

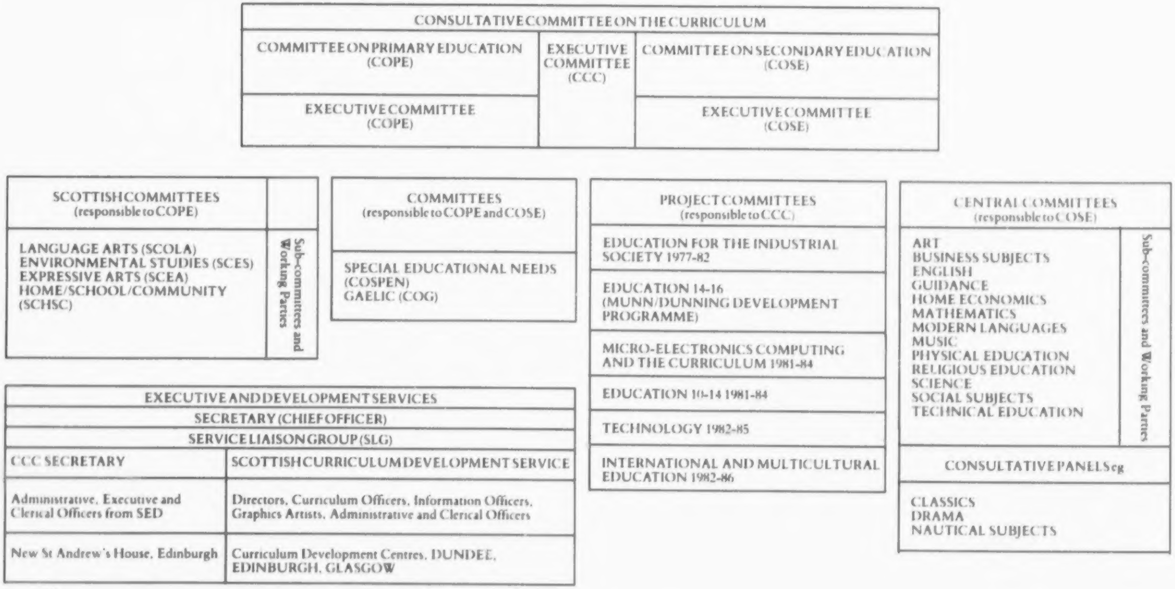
CONSULTATIVE COMMITTEE ON THE CURRICULUM
COMMITTEE ON PRIMARY EDUCATION (COPE)
EXECUTIVE COMMITTEE (CCC)
COMMITTEE ON SECONDARY EDUCATION (COSE)
EXECUTIVE COMMITTEE (COPE)
EXECUTIVE COMMITTEE (COSE)
SCOTTISH COMMITTEES (responsible to COPE)
LANGUAGE ARTS (SCOLA)
ENVIRONMENTAL STUDIES (SCES)
EXPRESSIVE ARTS (SCEA)
HOME/SCHOOL/COMMUNITY (SCHSC)
Sub-committees and Working Parties
COMMITTEES (responsible to COPE and COSE)
SPECIAL EDUCATIONAL NEEDS (COSPEN)
GAELIC (COG)
PROJECT COMMITTEES (responsible to CCC)
EDUCATION FOR THE INDUSTRIAL SOCIETY 1977-82
EDUCATION 14-16 (MUNN/DUNNING DEVELOPMENT PROGRAMME)
MICRO-ELECTRONICS COMPUTING AND THE CURRICULUM 1981-84
EDUCATION 10-14 1981-84
TECHNOLOGY 1982-85
INTERNATIONAL AND MULTICULTURAL EDUCATION 1982-86
CENTRAL COMMITTEES (responsible to COSE)
ART
BUSINESS SUBJECTS
ENGLISH
GUIDANCE
HOME ECONOMICS
MATHEMATICS
MODERN LANGUAGES
MUSIC
PHYSICAL EDUCATION
RELIGIOUS EDUCATION
SCIENCE
SOCIAL SUBJECTS
TECHNICAL EDUCATION
Sub-committees and Working Parties
CONSULTATIVE PANELS eg
CLASSICS
DRAMA
NAUTICAL SUBJECTS
EXECUTIVE AND DEVELOPMENT SERVICES
SECRETARY (CHIEF OFFICER)
SERVICE LIAISON GROUP (SLG)
CCC SECRETARY
SCOTTISH CURRICULUM DEVELOPMENT SERVICE
Administrative, Executive and Clerical Officers from SED
Directors, Curriculum Officers, Information Officers, Graphics Artists, Administrative and Clerical Officers
New St Andrew's House, Edinburgh
Curriculum Development Centres, DUNDEE, EDINBURGH, GLASGOW

Figure: *Organization of the CCC*

The Project was therefore concerned with the whole range of secondary education and it early decided that the word 'industry' in its remit had to be defined as comprising all areas of employment, not just manufacturing industry. As part of the CCC pyramid, the Project necessarily operated through existing curriculum development machinery, both national and regional.

With a remit of such breadth it was inevitable that, in the early days, the PPC spent much time casting around for a scent that would lead it towards the quarry that it had not yet identified. It took an important negative decision: not to attempt the creation of a new course on The Industrial Society that would further burden an already crowded curriculum. Rather, the strategy would be one of permeating and pervading the whole curriculum so that all teachers in all classes at all levels would be thinking in terms of the present-day world outside the classroom as well as within its narrow confines. The PPC established links with local authorities in order to tackle particular problems and these are listed in Table 1.

CENTRAL — Business Education
DUMFRIES and GALLOWAY — Practical Crafts
FIFE — Applied Science and Technology
GRAMPIAN — Careers Education
HIGHLAND and WESTERN ISLES — Education in Sparsely-Populated Areas
LOTHIAN — School - FE Links
STRATHCLYDE — Industrial Studies
TAYSIDE — Mathematical Requirements of Commerce

Table 1. *The PPC's Regional Links*

It also set up a series of Study Groups which had the task of advising the PPC, within its remit, on the topics in the Groups' titles. The Groups were Language; Numeracy; Science and Technology; Social Subjects; Microelectronics and Microelectronic Devices; Practical Crafts; Modern Languages. The publications that have emanated from this Project are listed in the appendix to this paper.

THE SCIENCE AND TECHNOLOGY STUDY GROUP

It was my privilege to chair the Science and Technology Study Group. It had a membership of twelve, more than half practising teachers and advisers but with representatives of industry, CBI and STUC, as well as tertiary education.

One of the tasks of this Study Group was to identify gaps in curricular provision in Science and Technology in relation to the expectations of relevant bodies within the industrial society. We had to examine how far the industrial society had an impact upon the teaching of science and technology in schools and vice versa. We had problems, however, in defining technology in this context. We were not primarily concerned with the appreciation of technology, which would be about the effects (favourable and unfavourable) on society and on the environment. We saw our concern with the use of technology, with the perception, formulation and solution of practical problems in the real world. Often this would involve the designing and making, or assembling, of a device to fulfil a need. After our report[1] was published, a DES Inspectorate report[2] described technology in these terms:

> 'Technology is concerned with the identification of the needs of man and the endeavour to satisfy those needs by the applications of science and the use of materials, resources and energy. It is concerned with solving problems where there is no right or wrong answer, only good or bad solutions to a problem. Technological behaviour requires activities that are creative and demanding, where the laws and principles of science, the constraints of society and economics are applied to problems of satisfying human needs. Technological behaviour involves approaches and techniques, such as system analyses, problem identification, decision making, planning, idea communication and solution evaluation, which are more than pure science or craft.'

A literal acceptance of that excellent description tends to suggest that the subject is beyond the limits of attainment of most school pupils! This is not entirely true of course, but one has to recognize that if one is going to become involved with technology at school, then much of the work, certainly up to the age of sixteen, is going to be at a fairly trivial level; one must question how great is the risk of turning pupils away, by the very triviality of what has been introduced.

Fortunately that definition was not before us in 1978 and we accepted a very broad description of technology (from a source that I cannot recall) which enabled us to read into it whatever we needed at the time: 'Technology is a disciplined process using scientific material and human endeavour to achieve human progress.'

We then asked ourselves three questions —

1. Should pupils be taught something about applied science and technology, about how their school work in scientific and technical subjects has applications in and reaches out generally into the world outside the classroom? If the answer was 'Yes' then the second question was 'When? Should it be in every year or in special years?'

2. Do our syllabuses in each of the years need revision or modification so that applications figure more prominently and occur more naturally? Our teacher members had said very firmly that if a topic was not examined then it was unlikely to be widely taught.

3 The final and vital questions were, 'Are our science- and technical-subject teachers trained and able to teach about these applications, and if they are, how do we keep them up-to-date?'

Speaking of the present situation in one of its documents, the Scottish Central Committee on Science[3] wrote:

> '... therefore it is questionable whether pupils have been given the most appropriate opportunities to acquire and use knowledge and to develop processes and skills which will be required in a society which is likely to have more job mobility, more job re-training, more leisure time and fewer working hours than at present'.

One of the first actions of the Study Group was to invite its STUC and CBI representatives to enquire of their members what were the characteristics most desirable in young people today, as far as their science training was concerned. We had hoped that we might obtain some idea of the background that best suited a youngster starting a scientifically- or technically-oriented career. With hindsight this was something that we should not have expected but the advice that we received was in itself quite revealing. 'The requirement is best stated as an understanding of basic scientific and technological principles, a mind educated to think logically in scientific matters, an ability to write simple English clearly, and to carry out simple calculations, a willingness to be adaptable and flexible in one's attitude to work and a preparedness to re-train and to work well with one's fellows.'

The Study Group's view was that education in schools must be relevant as well as educational, must be kept up-to-date and must prepare pupils for the work environment they were likely to encounter in the future, and must also provide them with an awareness of the science and technology which was around them in everyday life, both man-made and environmental.

This is not a conference, I believe, that is really concerned with the details of what we attempted and achieved, so I shall summarize the main areas in which we worked.

It has been claimed that for something to be taught widely and taught well, it has to be examinable. Implicit in this statement is the realization that, for external examinations, the majority of teachers take care to cover thoroughly those areas known to be questioned. Regrettably in Scotland, this has meant that very few pupils are made aware of many everyday applications of science. There is also lacking in Scotland the systematic approach to the development of practical skills so necessary to prepare young people for entry into a technological society. We believed that over-long syllabuses, inadequate in-service training and a lack of awareness of how to gain access to and to select from the useful literature published by many industrial houses, contributed to this 'examination-paper mentality' of certain teachers. Considerably more worrying was the fact that there were pupils who opted out of all science in S3 and S4 in Scotland (that is the two years before O-level in England) and others who rapidly became disenchanted by what certificate and non-certificate courses in the sciences had to offer.

We were quite convinced that it was possible, without changing existing single-subject science syllabuses, to introduce more of the applications of the science in the world outside the classroom. We tackled the published syllabuses in biology, chemistry, physics and technical drawing and identified those parts of each syllabus wherein relevant, up-to-date (and that is most important) applications occurred spontaneously. These applications included natural phenomena as well as industrial, for we believed that such understanding was important in the scientifically-literate community of the future. The syllabus comments appear in our report; they were also sent in April 1981 to the Scottish Examination Board and on to their subject committees. They were well received and their extent seems to have caused some surprise. Nevertheless, there the matter ends as far as the examinations are concerned unless the Examination Board, with its autonomy, decides to do something about it. The system is such that one can only work, as the Scottish baptism service has it, by prayer, precept and by example, and one cannot dictate.

Most published syllabuses are written in fairly terse terms. We set out to demonstrate the breadth and depth of the material that could be included in those brief syllabus headings. The Scottish Economic Planning Department made funds available for the pilot work, requiring only that we were developing up-to-date teaching material related to industry and industrial applications. In collaboration with SEB, we identified several appropriate topics. The term 'curricular insert' was coined to describe the function of the particular resource material to be inserted, as appropriate, by the teacher; I understand this clear description has, for some reason, been abandoned in favour of the more prosaic 'resource material'. Within the available time and budget, inserts were developed in physics for capacitors and electrostatics, and in biology for microbiology and pollution. They have again been very well received indeed by teachers, and by the Examination Board, but one still does not know how much use will be made of them in the classroom unless the examination system requires their study. We understand that the physics panel of SEB is making electrostatic devices one of its optional 'deep study' sections, so we have made some progress.

Our third main piece of work was more ambitious, to produce a new course on Applied Science and Technology. At the time that this work began, a pupil in his or her first two years of secondary school met some technical subjects, available now as a nationally tested Integrated Crafts course. The pupil also took a general science course, Integrated Science, and then had to choose between biology, chemistry and physics for the following two years up to O-grade. Some took one, some took two or three sciences, some took none at all. It appeared then, and it still appears, that all pupils in Scotland will eventually have to study some type of science up to school-leaving age. We believed that many of these pupils, the able but uninterested as well as the not-very-able, taking science compulsorily rather than voluntarily, would not be best served by a single science syllabus that was necessarily also a preliminary step towards a more thorough study of the subject, in later years.

So we conceived the idea — not a very original one — of a course of which the main purpose was to teach young people about the applications of science, about the scientific and technological world of today and possibly tomorrow. Local and regional interest would have to play a major role, both motivating and stimulating the interest of pupils and also in starting in them some possible employment aspirations. Ideally the course would cover both science and some technology and it had to be as relevant in Stornoway as it was in Paisley. A wide choice of material was therefore essential and the Group decided upon a unit structure — it would now be called modular, since that is the 'in' word in Scotland — with each unit a package that stood quite on its own, containing all the background material that a teacher would need to run it, including details of the practical work as well as pupils' notes and so on. One colleague summarized the aims for the course as looking at everyday products, processes and situations and asking of each, 'What is it used for, how does it work, why is it made that way, what did we do before it was invented or introduced, how difficult would it be to survive without it, how could it be improved, what does it not do that would be an advantage, is it potentially harmful to individuals or society as a whole and in its manufacture are its wastes a problem?'

Each unit was to last for not more than six weeks of teaching time and we found ready co-operation in Fife Region which helped both with the secondment of teachers to write the units and in the initial piloting. During the period of the Project, ten units were completed and piloted and two more were more or less finished. Sadly no revision was possible during the time of the Project. The material for those units exists but has not been published in the sense that it is not available for general distribution. The units are listed in the Appendix under Curriculum Materials.

The course Applied Science and Technology has been overtaken by other events and I shall refer to this again below. However, we proved three interesting things. First, we learned that an experienced teacher, an enthusiast for his subject, can still pitch his material at too advanced a level for his intended audience. Secondly, the type of approach we were following on this course could be very interesting, almost exciting, to the young people concerned. Moving from topic to topic tended to keep up the interest of the youngsters and the related practical work within and outside the laboratory stimulated some, bored few. Finally we proved beyond a shadow of doubt that the teacher is the clue to success. There is a unit on Coal and in one school it was very well received indeed by both teacher and pupils. In another school, it got a fairly negative response and only afterwards did we discover that the first teacher concerned had spent some years in the coal-mining industry before becoming a teacher; he made the subject live!

WHAT WAS ACHIEVED?

It is pertinent to ask, in conclusion, what were the achievements, if any, of the Project and, especially, of the Science and Technology Study Group. We have to set the publication of our papers and reports against the present turmoil. After a number of years of deliberation, consultation, trials and tests, the Munn and Dunning recommendations on the curriculum and on examinations are to be implemented; this means a complete change in the format of the examination system with three levels, so-called Foundation, General and Credit levels in the examination in S4, the old O-grade. The Munn philosophy results in a choice of core subjects and because there is to be a greater breadth, then there will be less time for each of the subjects in a given week in S3 and S4. The three levels, the reduction in time and a tendency to move towards modularization means that there is beginning a major reconstitution of many of the syllabuses. In addition, Government has just introduced as a crash programme, the 16-18 action plan, brought about by there being so many youngsters going back to school after the age of sixteen. Again, this is a modular plan with the splendid idea in theory of assembling modules as required to produce a desirable course for an individual. Much more fascinating to the outsider, the 16-18 action plan involves close collaboration between schools and further education; remember that the pupils concerned are probably not the most able, academically. Add to this the desire of many educationalists for cross-subject and cross-disciplinary courses, stir in the natural reluctance of a subject-trained teacher to teach anything far removed from his own area, add a dash of microcomputers and microprocessors and you have a teacher in considerable confusion, a confusion that I believe will exist for some years yet. It is into this that we are trying to introduce our Industrial Society hopes and the original decision taken before the Munn and Dunning reports were published, to permeate and pervade the curriculum, is both a strength and a weakness. A strength in the sense that the alternative proposal to produce a course on the Industrial Society would almost certainly have resulted in our work dying, starved out by the competing claims of well-established courses. A weakness in that we are unable to sustain the pressure needed to keep the Industrial Society work always before all of those involved in the many redevelopments.

During the latter part of the Project, some of the individual projects and publications have certainly made an impact, for example, the Numeracy reports, the report on A Language for Life and Work and the Industrial Relations exercises. On the science side, the curricular inserts are certainly a success and they are going to have a lasting influence, but they are few in number. Our identification of applications has certainly opened some influential eyes and I believe we shall find these applications in more and more of the science syllabuses. Applied Science and Technology as such will die, or is dead. This is very sad to me but in the Munn developments there is now a subject called Science and it is likely that several of our units will be included in the core-plus-options routine that will inevitably be followed for the subject. Moreover, I have heard of a most interesting proposal at least to consider the teaching of physics at General level via its applications. So we have made people think — at least we like to pretend that we have provided the friendly irritant that has brought the thinking of some of our powerful colleagues up to the end of the twentieth century in each of the science subjects.

A BRIEF SUMMARY

In the foregoing I have tried to present the Project factually. In these final few paragraphs, the thoughts are mine and not necessarily those of my colleagues.

I believe we have to accept that the major achievements of the Project have still to come in the sense that we have shown what is possible in Scotland, we have shown where young people can be interested and it is now up to others, sadly in a way, to make the changes necessary to ensure the further enactment of our embryo schemes.

We say in the final report of the Project[4] that we must define and develop those parts of the curriculum that are essential if young people are to understand our industrial society, and if that society, in which we all live, is to prosper. That is a message that will be fairly readily accepted by most people in the teaching world and yet there are undoubtedly many who will believe, for one reason or another, that there is no need to change either the practices or the syllabuses of recent years in order to achieve that aim.

The key to all changes, to all developments, is the teacher and his or her willingness and ability to teach about the world outside the classroom. Let me refer again to that Coal module, where, taught by an ex-mining man the result was superb, while taught by a disinterested chemistry teacher the result was near-disaster. In tertiary education, we are given the time to keep ourselves up-to-date, and without this we should soon be unable to teach effectively. I believe that only lip service is paid to the same vital need in Scottish secondary education.

We have got to look very carefully at the initial training of our teachers, but particularly and essentially as far as the sciences are concerned, we must have an extensive and exhaustive system of in-service training that keeps the science teacher and his or her engineering counterpart perpetually up-to-date. We tried to tackle the question of resource material, spurred on by one of our CBI men, an industrial chemist, who expressed himself quite horrified at some of the so-called industrial examples given in textbooks in current use. There were references to manufacturing practices that were certainly obsolescent and possibly obsolete. No fault of the textbook writer, he was writing perhaps twenty years ago. No fault of the reader, he was not to know that things had changed. But somehow up-to-date information has got to be kept supplied to the schools and teachers have got to be given the time *and the incentive* to keep themselves properly informed of relevant modern developments.

It is a sad reflection on our examination, our education system, that our teacher members were strong in their belief that for a topic to be widely taught, it had to be potentially examinable. If that is true, the examinations must play their part by reflecting the modern applied scientific and technological trends, so that the introduction of these discussions into the classroom is natural.

I am satisfied from our experience that a great deal can be done to make applied science and, to some extent, technology both acceptable to staff and stimulating to pupils. There will be an uphill struggle against entrenched ideas but the first tentative steps have been taken.

References

1 *Applied Science and Technology for Scottish Secondary Schools*, Study Group Report, SCDS, Jordanhill College of Education, Glasgow, March 1982.
2 *Technology in Schools*, Inspectorate Report, Department of Education and Science, 1982.
3 *Science : A Curricular Review*, Scottish Central Committee on Science, Occasional Paper No 4, SCDS, Dundee College of Education, 1980.
4 *An Education for Life and Work*, Final Report of Project Planning Committee, SCDS, Jordanhill College of Education, Glasgow, 1983.

APPENDIX

EDUCATION FOR THE INDUSTRIAL SOCIETY PROJECT

FINAL REPORT

An Education for Life and Work — June 1981

OTHER REPORTS

Mathematical Requirements of Commerce — June 1981
Post O-Grade Modern Languages: The Needs of Industry and Commerce — September 1981
An Outline of Careers Education throughout the Secondary School — September 1981
A Language for Life and Work — November 1981
Teacher Secondment to Industry — February 1982
Applied Science and Technology for Scottish Secondary Schools — March 1982
Microcomputers and the Secondary School — March 1982
Secondary School Projects and the Microchip — March 1982
Management Courses for Senior Pupils — June 1982
Education in Sparsely-Populated Areas — August 1982
The Teaching of Industrial Relations — September 1982
Numeracy and the Secondary School — November 1982
Business Education — January 1983
Links between Schools and Colleges of Further Education — February 1983
Social Subjects for the Industrial Society — February 1983
Industrial Studies — March 1983
Practical Craft Skills — March 1983

RESOURCES FOR TEACHERS

Biology: Pollution; Microbiology
Business Studies and Economics: The Toy Industry; Economies of Scale
Geography: The Location of Mining and Energy Production
Modern Studies: The Impact of Technological Change on Society; Industrial Relations: A Depth Study
Physics: Capacitors; Electrostatics — Uses and Hazards

CURRICULUM MATERIALS (Presently undergoing pilot testing)

Business Education
Industrial Studies — Work Experience
    Industrial Relationships
    Understanding Industry
Applied Science and Technology —
    Introductory Module
    Biotechnology
    Coal
    Communications
    Corrosion
    Electricity in the Home
    Electricity — Source to Consumer
    Forestry
    Metals
    Microelectronics
    Oil
    Polymers
    Problems of Waste Disposal

ROYAL SOCIETY OF CHEMISTRY MATERIAL

    Zinc and You
    Nitrogen and the Nineties
    Organic Liquids Containing Oxygen
    To Market a Drug
    Titanium
    The Vinyl Chloride Problem

8.1

Youth Employment and Unemployment. Implications for Education and Training

C. L. Marsden*
The British Petroleum Company plc

INTRODUCTION

This paper has been written as a follow-up to one I wrote entitled 'Is there a role for industry in determining the curriculum?' That paper, which arose out of requests for talks on why BP is involved with education, outlined the evolution of the Company's educational liaison objectives and their implications for changes in the school curriculum, considered the obstacles to achieving these changes and argued that good schools/industry liaison could contribute greatly to overcoming them. Since then further issues have emerged on which I have been asked for a view, often as a 'spokesman for industry'. These issues centre on youth unemployment and its implications for education and training.

The present paper highlights the following needs:

1 To involve effectively the community, including industry, in what goes on in education.
2 To rethink our attitudes towards work and, thereby, seek more opportunities for young people to make a worthwhile and rewardable contribution (work in the widest sense).
3 To encourage the 'self-employment option'.
4 To develop 'progression' in education and training for all young people through to age 19 and beyond.
5 To discourage employers from using traditional academic measures of success as pre-selection devices.
6 To encourage the rapid adoption of alternative, externally validated, methods of assessment, at least up to the age of 17, which will:
   (a) test a much broader range of skills and attributes;
   (b) encourage a greater sense of achievement and motivation for all young people;

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*Editor's note: The first of Christopher Marsden's two papers (8.1) was circulated to participants prior to the conference. His presentation was a development of views expressed in that paper. Subsequently he kindly summarized points from his presentation in a second paper (8.2). In view of the interest shown in his original paper and in his presentation, both papers are included here.

(c) encourage the development of the skills and attributes so often referred to in education/industry conferences.

7 To provide the necessary in-service training for teachers.

THE YOUTH TRAINING SCHEME CURRICULUM

All employment forecasts indicate long-term high levels of unemployment, particularly among the youngest groups for whom unemployment rates are rising fastest. The Youth Training Scheme (YTS) may be seen by many as the Government's response only to the short-term political necessity of being seen to be doing something about the problem. The Manpower Services Commission, however, states its objectives in terms of long-term manpower planning needs which have much more permanent implications. These include:

1 Teaching new skills to get over the mismatch between current skills and future needs (e.g. new technology and the shift from blue-collar to white-collar occupations).

2 Raising the overall skill level of the workforce to raise its employability, especially in readiness for the hoped-for upturn in the economy.

3 Giving 16–19 year olds a sense of purpose and achievement.

YTS emphasizes a flexible training approach and the concept of skill 'ownership' which can easily be transferred between jobs. Motivation will be achieved through providing learning opportunities using an occupational base and real work. The YTS 'curriculum' contains 'life and social skills' as well as many of those related to basic numeracy, literacy, making and doing, problem-solving and teamwork that industry has been requesting for so long. The MSC has produced a matrix of skills and levels of achievement for which it hopes to produce a standardized profile-style certification, irrespective of the nature of the work placement, which can be used for transfer to any future job or further education route. This is not seen as either an extension of education or an alternative to work, but rather as a bridge between education and work which should ultimately be provided for all young people, not just the unemployed. Further education, in effect, will become an integral part of the labour market, with teachers developing a new role visiting places of work and with considerable movement of staff between institutions.

The proposed YTS curriculum is highly 'political' because of its aspects of social control and the large amounts of resources required to teach it. It has been suggested by the MSC that the curriculum is now 'owned' by the community, no longer just the educationalists. With industry being a major part of the community it is important that it should recognize its function not just as sponsor and provider of YTS placements, but also as active participator in the debate about the YTS curriculum, its relationship with the rest of education, and the future for which young people are being prepared.

The MSC's proposals raise a number of questions: Is the community capable of responding to this new responsibility of 'owning ' the curriculum? Can industry with its diffuse nature and current concern for short-term survival respond effectively? The apparent lack of interest shown by industry in a recent conference on the implications of YTS, sponsored by the MSC and BP at Dundee University, suggests it cannot. It was pointed out at the conference that while in Britain there is considerable interest (among the middle classes) in schooling, especially public schools, in order to achieve the recognised success tickets, there continues to be a traditional lack of interest in training compared to that in other countries.

Will YTS be seen as more than a means of containment and control; keeping unemployed 16–19 year olds off the streets? Will it become a genuine bridge between education and work, or will it simply be an extension of education? Will the YTS routes be motivating if there is little prospect of employment afterwards? After all, training deficiencies are not the cause of the current high level of unemployment; so with a forecast continued fall in conventional job opportunities, why raise the emphasis on work experience training?

These are highly political questions, but they require answering by all those with an interest in long-term prosperity and social stability. Major companies may no longer hold out the prospect of being big employers, but they will continue to be big wealth creators, assuming that society continues to give them a licence to operate. To maintain this it is important to ensure not only that a company's activities are understood and valued but also that developments in the education and training of all young people are not left to chance but influenced in the direction of what forecast future changes in the nature of work clearly indicate they should be. What are these forecast future changes? What are the necessary developments in education and training and what can industry do to help?

TRAINING FOR WHAT?

The predicted rise in the working population will continue to exceed considerably even the most optimistic forecast of job opportunities. On the supply side there will eventually be a drop in school-leavers by the late 1980s but this will be counterbalanced by a continued rise in activity rates, particularly among women. On the demand side, even assuming a gradual upturn in the economy and an average 2% annual growth rate, there will be continued reductions of employment in the manufacturing sector and any natural reallocation to the tertiary sector will be stemmed by the advance of the microchip. Even worse than the high overall level of long-term unemployment is the unequal distribution according to age. While overall unemployment rose three times in the period 1972–82 and long-term unemployment rose five times, the figures for the age groups 20–40 and 16–19 were twenty times and twenty-five times respectively. These figures are being reinforced by headteachers currently tracing the destinations of this summer's fifth-year pupils. One large comprehensive in the North East, with a very good reputation, reports the following breakdown:

Sixth form/Further education	42%
MSC schemes	23%
Unemployment	21%
'Real' jobs	10%
Unknown	4%

This education 'staying on' rate is higher than ever before and above average for the North-East. Some of these, of course, as well as many of those on MSC schemes, will go onto the unemployment register in a year's time. In a few years there are likely to be many young people in their early twenties who have never had a 'proper' job.

All kinds of imaginative schemes are being suggested to reduce the supply side of the equation, including early retirement, longer holidays and job sharing. However, no forecast suggests these can ever be sufficient to solve the problem. It appears likely that in the future millions of people can no longer look forward to the security of a conventional, paid job. Yet, apart from a tiny minority of so-called scroungers, these people will desperately need the opportunity to make a contribution to society (work in the widest sense), to achieve their self-identity, a sense of fulfilment and earn a living. What is required is a rethinking of our attitudes towards work. The Protestant work ethic is being increasingly called into question at conferences of teachers and industrialists. It is recognized that there is little virtue in being 'at work' as such. It will be a blessing when many of the more tedious, repetitive jobs are taken over by machines. There is also no value in keeping open or 'creating' jobs where there is little real work to be done. The prospect of greater leisure should be welcomed. There are, of course, plenty of worthwhile contributions to be made. Besides conventional employment, which will still be available for the majority, there are limitless opportunities for work which will add value to the quality of life, whether in the home, in the community or in a variety of personal services, if only the necessary enabling action is taken.

The problem is partly one of attitudes and the status derived from a job. Personal service is regarded as demeaning, community work is traditionally voluntary and for 'do-gooders', while housework and childminding are non-jobs for unliberated and discriminated-against women. It is ironic that at a time when the contribution of domestic stability and parental care to the education of children is increasingly being recognized, the number of women seeking paid employment rises faster than ever. The point is not that the woman's place should be in the home, but that there is a job to be done there and ways should be devised to encourage people (men or women) to do it. It should be possible, with a little imagination, to think of ways that will encourage both changes in work patterns involving more part-time work and job-sharing and the broadening of activity that is regarded as 'work' and from which a living can be earned. This can be done within the mixed economy, encouraging individual initiative and entrepreneurial ability as well as a greater preference for leisure time and domestic life, through appropriate changes in tax and social security structures and education and training practices.

At a time of so many negatives regarding jobs it is worthwhile exploring the possibilities of one very positive development: education for self-employment and starting your own business. Although by itself it will not solve the unemployment problem, it is likely that many of the jobs created in the future will be in small businesses. The idea of working for yourself, going out and doing something that someone else is prepared to pay for, rather than simply waiting for the offer of conventional employment, is not something included in many schools' careers programmes, but it surely must be worth encouraging. There are techniques and information that can help develop young people's thinking along these lines and prepare them for some of the problems they would be likely to face.

ROLE OF EDUCATION

If it is accepted that a major function of the education process is the inculcation of values and the attitudes associated with them, then schools and colleges must have a crucial role to play. This includes preparing young people for the process of providing for themselves; providing them with the necessary skills and encouraging the appropriate attitudes for earning a living in a world of rapidly declining conventional job opportunities, continuous change and uncertainty. Some of these are identified even if rather loosely in the proposed curriculum of YTS, particularly in the area of 'life and social skills'. Many of these and others are already being tried in a number of schools in various parts of the country.

One of the privileges of working in a Company's educational liaison function is the opportunity both to see good practice taking place in schools with which we associate directly and to hear of many other examples from organizations such as The Careers Research and Advisory Centre, the Centre for the Study of Comprehensive Schools, The Schools Council Industry Project, the Science and Technology Regional Organisations and the Scottish Education for the Industrial Society Project. Several schools already have teaching programmes in skills associated with communication, thinking, problem-solving, teamwork and designing and making. They are also developing assessment techniques that test specific abilities, providing a profile of achievement, and even involve children themselves in appraisal of the achievement of targets, similar to the staff appraisal systems used in many firms.

In relation to the country's 6,000 secondary schools, however, these amount to only a few scattered examples and there is no overall pattern of development. An increasing number of headteachers and their staffs are worried about the inadequacy and irrelevance of much of the secondary-school curriculum but feel helpless to combat the external constraints of traditional attitudes, examination syllabuses and lack of resources to develop and retrain teachers. It is probably because of this perceived inability or unwillingness of schools to change that the MSC has deliberately ignored the traditional school system in its proposals for YTS. It is widely viewed as a remedial measure brought about by the failure of schools to prepare young people adequately for the world of work. The danger of this lack of communication is that the YTS curriculum will take no notice of what goes on at school and vice versa. There will be no 'progression'; with some children actually repeating things they will have done at school, while others are totally unprepared for the new experience. This lack of progression and, therefore, lack of any thinking through of the whole process of education and training to the end product is also preventing serious, unified consideration of the implications for this process of the changing nature of work . It is to be hoped that this short-term 'remedial' measure will in fact act as the catalyst for a comprehensive scheme of education and training for all 16–19 year olds and the necessary changes in the pre-16 school curriculum to prepare for it.

INDUSTRY'S DOUBLE-TALK

On the face of it industry is doing much better than it used to in telling education what it wants and, partly because jobs are hard to find and partly because of improved industry/education liaison, education is more prepared to listen. At interviews, graduate recruiters look for critical reasoning, communication skills and commercial awareness, while recruiters of operatives stress attitudes like versatility, initiative, pride in the job, getting on with others, good timekeeping and loyalty to the team. At meetings all over the country employers are telling teachers that there should be more emphasis on the basic skills (e.g. communication and practical numeracy) and how to apply them in a variety of situations, teamwork, problem solving (without the answer in the back of the book), economic and business understanding and so on. All of these are to be highly commended and involve general, non-job specific attributes that would help prepare youngsters for both conventional employment and self-employment. Unwittingly, however, while urging through its words these changes on schools, industry by its actual deeds is encouraging the maintenance of the poor curriculum design and teaching practices which prevent the changes from taking place.

There is a vicious circle regarding employers' use of examination results. In order to keep recruitment costs down (the number of interviewees to a manageable level) employers inevitably have to use a cheap but effective screening device. The number of 'O' level and/or 'A' level results provides a convenient method and is used even by recruiters of graduates, before degree results are known, in order to reduce thousands of applicants to a manageable number. They are even more used by recruiters of 16–19 year olds, often with scant regard for job requirement, as shown by a recent advertisement for audio typists that required four 'O' levels including English and Mathematics. It is interesting to note that this would be illegal in the USA, where employers are liable to prosecution if their stipulated job-qualification can be shown not to be required for the job in question. This is not to suggest that 'O' levels do not mean anything, although they mean far less, especially English Language, than popular belief would suppose. The system has established 'O' levels as the objective and those passing the greatest number have shown themselves capable of the discipline required to achieve that objective; often hours of rote learning and a good memory. Although these are not the qualities being looked for by employers, as a pre-selection device it is cheap and seemingly effective. Particularly in a buyer's market, it leaves plenty of capable people to choose from at interviews, which can then be used to select those with the desired abilities mentioned above.

The message received by schools, however, is that whatever employers say they want in their recruits, the initial hurdle requires examination passes. Employers therefore like exams, especially mathematics and English, and exam results are seen as the ticket for jobs. Naturally, parents and children demand that schools gear their teaching to the achievement of as many exam passes for their pupils as possible. Headteachers, hard pressed for numbers in times of falling rolls, will stress examination results and their classroom teachers will follow suit, quite happily as it is what they are used to and an easy excuse to continue teaching what they have always done without much regard for relevance. Exam results become the main objective of the school and the obvious external measure of educational success. Employers, with no alternative measure, continue to use exam results and the vicious circle continues.

The result of this in a time of severe recession is, of course, for stipulated exam requirements to be raised, exam results to be stressed by schools and parents even more, employers to over-recruit people with higher 'academic' attainment than required and for the school curriculum to become less and less relevant for more and more pupils. A system which stresses exam passes in subject matter which of itself has little relevance is only relevant to those who can use the results for another end. The long-term consequences are disturbing both for those who are in jobs which fail to stretch them and for the increasing number who do not get enough passes to get a job at all. The concept of the 'lost generation' begins to assume reality. Young people's anger and frustration will turn into a strong apathy which at best will be a permanent loss to the economy and at worst will lead to serious social division and trouble.

COLLECTIVE ACTION

The lesson for employers here is not an easy one to digest. At a time when recruitment is much reduced, costs are being cut wherever possible and thoughts concern survival in the short term, they are being asked not to take short-cuts in recruitment policy and to take the longer-term view, even though current pre-selection based on examination results seems to work satisfactorily. If young people are to receive the kind of education that will prepare them for the uncertain future and give them hope and confidence to make a worthwhile contribution to that future, industry must be prepared to take a lead and support the fundamental changes necessary. Talking about the need for change in broad, generalized terms at meetings involving education and industry on the one hand, while supporting traditional attitudes as recruiters and parents on the other, will not do! It is also wrong, however tempting, for large firms who are most concerned in recruitment terms with the cream of the graduates, only to consider that part of the system which most immediately produces these; sixth-forms and universities. The foundations of skills and attitudes are laid well before then, and it is the 11–16 curriculum which is most in need of change. In any case, industry's concern must be with the whole spectrum of young people as the next generation of producers, consumers and voters; a concern which it cannot afford to delegate.

It is no good calling for curriculum change unless you provide an accredited form of certification to go with it. There is immense public confidence in the 'O' level, even if it is largely misplaced, and realistically the demise of subject-based examining at 16+ can only be gradual. However, much encouragement can be given to the development of criterion-referenced tests which specify levels of achievement in a whole range of skills and activities and the use of this information as part of a profile of each pupil's achievement — a statement of what a pupil can do, rather than an exam system that stresses the concept of 'failure'. Education must realize that employers do need pre-selection screening devices and should work quickly to develop a system that will encourage the curriculum change most people wish to see. Speed is of the essence and the normal pace of educational change is far too slow. It is hard for industry to understand that deliberations on a system of common examining at 16+ are still going on after five years. The change might have been relevant ten years ago — now, the whole concept of subject-based examining at 16+ is being called into question.

New forms of assessment do not have to be tried and tested over many years in order to be 'perfected', however desirable that might be in an ideal world. The present system is so imperfect that currently available tests and profiling systems should be added quickly to the existing pupils' assessment package, and improved over time as experience is gained. Schools, Colleges of Further Education and the MSC should get together, co-operate, admit what each can do best and devise systems of assessment that will allow progression, options to be kept open for as long as possible, fostering the concept of education and training continuing through to 19 and even throughout life. There are enough examples of good practice in schools and good ideas within the YTS proposals to suggest that these changes could take place, given the right encouragement and concerted action by the education system's users, chiefly employers.

It has been argued, perhaps over-optimistically, that good schools/industry liaison can help to overcome some of the obstacles to curriculum change. With schools opening their doors more to the community in general and industry in particular, attitudes would be changed on both sides, the huge potential of resources from the community, both physical and human, could be more effectively tapped and this greater exposure to the 'outside world' would go some way to remotivating teachers and stimulating new ideas. It has become clear that this cannot be done without industry recognizing the full implications of its responsibilities for schools, both as recruiters and corporate citizens. If, as the MSC claims, the community 'owns' the curriculum it must also 'own' the system of assessment to which the curriculum is directed. The community, and industry as part of that community, had better find a way of deciding on the changes it wants and supporting their implementation by its actions as well as its words. Instead of being an obstacle, industry (employers) could become a major force for curriculum change, influencing the two other major obstacles, parents and universities, alike.

The final obstacle, existing teachers and the system of teacher training, could then be faced directly. Much retraining would be necessary, especially as many teachers would be required to abandon pure subject-based teaching. This would require additional resources and industry should support this. For the minority of teachers, unable or unwilling to change, suitable ways out of the profession would have to be found. An interesting spin-off from the increased contact with industry over the last few years has been the interest shown among teachers in industrial training, particularly in communication and management skills. There are now many examples of headteachers and the others attending such courses and enthusing about both the content and the teaching methods used. There is also interest shown in staff appraisal and development systems used in industry, something almost totally lacking in the teaching profession. There is much therefore that industry can do to encourage and help teachers move in the direction suggested by this paper.

Too often in gatherings of those from education and industry the very genuine desire of the former to learn precisely what the latter wants is frustrated by the lack of a clear, concerted message. Education is opening its doors to the community and asking for help from outside. It is up to industry, although a difficult collective group to identify, to respond and not to give conflicting answers. Large firms, although not entirely representative of all industry, are perhaps rather more secure and better able to take the longer-term view. They should be prepared, in spite of preoccupation with severe and immediate business problems, to give time and attention to respond to this challenge. As the Principal of St Andrew's College of Education said when opening the recent prestigious Scottish conference on *Education and Industry*: 'There is a need for collective action on a faster reading of the signs of the times if appropriate change is to take place quickly enough'.

8.2

What Industry Really Wants. Implications for Education and the Community

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PREFACE AND SUMMARY

This paper is written as a sequel to *Youth Employment and Unemployment*. It is an attempt to summarize the subsequent discussion and developments in thinking arising from a paper which has had a major influence in the formulation of BP's policy regarding educational liaison.

The main conclusions drawn are as follows:

1. Education and Industry need one another.
2. Industry wants education to provide all young people with a relevant general education and the opportunity to pursue excellence, whatever form it takes.
3. Preparation for the changing world implies that all pupils, whatever the nature or level of their ability, require competencies additional to those encouraged and measured by traditional examinations.
4. Traditional attitudes towards ability and assessment will only change if education and industry together clarify mutually acceptable long-term targets.
5. Schools need a new form of 'social contract'; a relationship with the community which results in mutual understanding and support.
6. As the stimulus for change often comes from outside, all teachers should be encouraged to link with external networks for their own professional development and accountability.
7. In order to manage change, schools need to have clear objectives and regular reviews of progress.

8 The emphasis of the teacher's role should change from that of subject-specialist lecturer towards that of manager of learning experiences with a view of the whole curriculum.

WHAT INDUSTRY REALLY WANTS

The most important conclusion to be drawn from the paper *Youth Employment and Unemployment* is that education and the community are interdependent. Industry, which must be defined to include the whole commercial sector, makes up a major part of the community.

Education needs industry:

1 to help resolve the confused expectations society has of schools;
2 to play its part in the developing community involvement in the educational process.

Industry needs education:

1 to promote a general awareness and understanding of its activities to show young people generally the contribution it makes to their standard of living;
2 to encourage a more appropriate preparation of young people for the rapidly changing world of work;
3 to attract a fair proportion of the most able to choose an industrial career.

At a time of rapid change young people, who face such an uncertain future, are increasingly asking questions about the purpose of education, the nature of work, and the role of industry and commerce. People in education are discovering that they need to reassess and renegotiate their objectives with young people, parents and the community. Industry also has to justify its role to young people if there is to be a better understanding of the need for an appropriate balance between the contribution made through output and taxes and the rewards received through employees' earnings and profits.

Industry is regularly accused of not making its voice clear and of being narrowly concerned with its own needs. Industry is an amorphous mass and has no one voice. The answer to the question, 'What does industry want?' will inevitably vary according to the experience and knowledge of the respondent as well as the context in which it is asked. Several years' experience of attending education/industry gatherings suggests, however, that the broad message is clear. What industry really wants, and can legitimately ask for, is that a relevant general education is provided for all pupils and that the pursuit of standards of excellence which recognize all types of ability is fostered.

A relevant general education is one which, amongst other things:

- prepares young people for future work/activity in all its possible forms;
- provides motivation and hope for the future without disguising the level of uncertainty;
- has coherence in the mind of both teacher and taught and so is able to provide convincing answers to the question, 'What is the point of doing this?'

The key areas of understanding and competence need developing in all young people irrespective of the nature or level of their ability. They include economic literacy, technological capability and a whole range of communication and interpersonal skills.* The academic high-fliers need these areas of learning as part of their general education, as much as anyone else.

Traditional attitudes towards 'ability' and the higher forms of learning are far too narrow in this country. For this to change, other abilities, especially technological capability, must be encouraged before specialized options are chosen and recognized thereafter in the pursuit of excellence through to higher education. It is not acceptable for the 'top 25%' to be given only a traditional diet of 'O' and 'A' levels, and to limit reform in education to the curriculum of the middle group or even of the bottom 40%. It is not just the 'lower' groups who are going to face periods of unemployment, the need to look for less traditional forms of paid activity, and have competencies other than those traditionally encouraged by conventional examinations. Current levels of graduate unemployment help to show that the pursuit of excellence must include the development of the ability to go on learning, of self-reliance, and of self-starting, all so necessary for a rapidly changing world.

Academic exams will undoubtedly continue to be used for many years but their inadequacy as predictors of future performance must lead to the development of other forms of assessment. Recent publicity given to the 'crammers' where 'A' level failures can achieve higher grades by paying £1,000 a time for short-term cramming has exposed the limitations of this measure of attainment.

Many teachers still distrust industry's view of education as being narrow and selfish, concerned with 'fodder' for its own needs, rather than the needs of the young people themselves. What is being attempted here, however, is to identify the common desire of industry, commerce and society as a whole for young people to be prepared to face a changing future with appropriate skills, attitudes and motivation. Industry is not asking for them to be trained for an immediate role but, in recognition of the extent and pace of change, arguing for their better preparation for a role in future employment whatever form that may take.

The pursuit of developments in education along these lines faces three major problems: attitudes towards assessment; the mutual ignorance of teachers/academics and employers; and the role of the teachers.

ATTITUDES TOWARDS ASSESSMENT

The paper *Youth Employment and Unemployment* raises the problem of employer 'double-talk'. There is often a conflict between what employers say they want in their recruits and their use of initial examination hurdles which positively discourage this. In addition, great respect is given, with strong university and parental support, to what is most easily tested — factual recall.

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*These form the basis of *Learning for a Changing World*, a teacher in-service training initiative being taken by BP Educational Liaison. Further details available on request.

There is also widespread reluctance among teachers to assess the abilities of their pupils from an early age, objectively, in relation to specific criteria, and discuss these openly with parents and the pupils themselves. The combined effect of these is to concentrate all thought and efforts on the 16+ hurdle, upon which life chances are seen to depend.

Assessment of all pupils is essential: pupils need targets and records of achievement; schools need, and society requires, externally accredited standards; employers need pre-selection criteria. Instead of further consideration of the inadequacies of the present system and the painful process of changing it, it is worthwhile clarifying ideas on the assessment 'package' of the future towards which we should be moving.

Key features of such a system would include:

- recognition of a wide range of skills and abilities;
- creation of individual records of achievement from, at least, the beginning of secondary school;
- tests and exams to be less age-related, enabling life-chances to be kept more open and allowing for the increasing need for retraining and 'top-up' courses;
- flexibility to allow for transfer between school, college, on and off the job training, periods of employment, unemployment and higher education;
- the pursuit of excellence in all its forms should be appropriately tested to break down its automatic equation with traditional academic excellence. Qualifications and experience gained through work experience should have parallel recognition with those gained through continued formal schooling.

There are signs that these things are beginning to happen. Enlightened industrial trainers are commenting on the high quality of some of their YTS recruits, noting that some of those with no exam qualifications prove capable and quick to learn. YTS records of achievement are becoming useful qualifications and have significant influence on the development of school-based assessment. Similarly the Technical and Vocational Education Initiative (TVEI) could raise the status of technological capability and other 'non-academic' skills and encourage their development amongst the most able, if it remains true to its declared objectives of providing for the whole range of intellectual ability. It is important that the new Certificate of Pre-vocational Education (CPVE) at 17+ is seen as an integral part of this rather than something separate. The same goes for Further Education courses, now moving in a promising direction through the merging of BEC and TEC and the developments in City and Guilds systems of assessment. The resurgence of calls to broaden the sixth-form curriculum and criteria for selection to higher education must be strengthened by these developments. This leaves only the combined 16+ examination, so long awaited yet now of questionable value since few if any pupils will leave the emerging system of full-time education and training between ages 14 and 18.

It is probable that we shall have to put up with the continuation of formal examining at 16+, based on criteria more concerned with past traditions and vested subject interests than the needs of the future, until the new alternatives have proved themselves. This will mean increased burdens on teachers and pupils through the greater amount of assessment needed during the process of transition. The length of this process, however, will depend largely on the success education achieves in its community involvement and the breaking down of mutual ignorance, which is the second main problem area and the subject of the next section.

EDUCATION AND THE COMMUNITY

There is still a strong tendency among teachers to regard community involvement as raising money for charity, good works and, perhaps, learning how local government works. Industry and commerce are often not seen as part of the community and links with them are left to the careers teacher and certainly not allowed to interfere with the mainstream of the curriculum. Meanwhile, contacts with parents tend to be limited to matters concerning individual children and to appealing to their self-interest to participate in PTA fund-raising activities. Parents are rarely involved in discussion about curriculum issues. On their side employers and parents, not of course mutually exclusive sets, tend to assume that they know all that needs to be known about education, making the assumption that not much has changed since they were at school.

Many of the prejudices which stand in the way of change stem from this narrowness of interest and mutual ignorance. This can be illustrated by lack of clear understanding of the meaning of many of the words involved. To how many teachers do 'Industry' and 'Engineering' still conjure up pictures of dark satanic mills and working on dirty machines? How many regard 'profit' as unearned income and 'wealth creation' as that which makes the rich richer? On the other side, how many people outside schools consider Mathematics and English to be synonyms for numeracy and communication skills, and careers education to be about finding jobs? And who really understands the phrase 'curriculum development'? Janet Jones in her recently published report on Employers' Use of Examination Results* describes how most employers automatically said they preferred 'A' level Physics to 'A' level Technology. When shown the two syllabuses without the subject headings, however, the majority picked technology as being more relevant to their needs.

Education needs a new form of 'social contract', a relationship with the community which can bring about the necessary mutual understanding and support. There are community schools, some officially designated as such and some not, which are succeeding in this direction. Not only are their premises continually open for 'community education' purposes, occasionally even with adults sitting alongside youngsters in class, but also there is a regular two-way flow of people offering first-hand learning opportunities for children outside and the use of adults other than teachers inside the classroom. In all cases there are major contributions from local industry.

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*Janet Jones: Research into 'The Uses Employers Make of Examination Results & Other Tests'. Copies available on request from BP.

The broad conclusion of a number of national and local education conferences over recent months has been that we should move towards community schools. Conference resolutions tend to be more easily stated than carried out and such a movement does require considerable change in school organization and the development of new skills for teachers.

THE ROLE OF TEACHERS

Change requires both stimulus and management. The stimulus rarely comes from within. All professionals need outside contacts and networks of colleagues to provide sources of new ideas, advice and criticism. All teachers should be encouraged to link with external networks for their own professional development and accountability. These would include subject associations, curriculum development projects, examination committees, and a wide variety of schools/industry organizations. One such network is the Centre for the Study of Comprehensive Schools, which is compiling an impressive data bank of examples of the kind of developments being encouraged in this paper from schools all over the country. Members provide information about their own activities and in return are able to make contact with other schools developing similar ideas or facing similar problems.

The management of change requires clear policies. For instance, a school should have a policy for outside contacts co-ordinated by a senior member of staff. Objectives have to be set and kept under regular review. This involves much more communication between staff than is often the case at present and, ideally, the development of a system of staff appraisal and development. Closer liaison between schools and industry has increased interest among teachers in the concept of staff appraisal. Teachers seconded to industry have been impressed by the positive aspects of formal staff appraisal, particularly when linked with consideration of career development. Many would welcome the chance to discuss how they were doing, in relation to mutually agreed criteria, with a senior colleague. Others, used to the independence and isolation of their subject and classroom, would feel threatened, as they do on the rare occasions when they teach in front of an inspector or even a student.

These teachers may well become a diminishing minority as 'across the curriculum' considerations, team teaching and external involvements increase. If teachers are to break the prejudice held by many outside the profession that they have an easy life with short working hours and long holidays, they need to be seen at work. They also need to expose the minority of their colleagues who help to reinforce this prejudice. It is not enough for the dedicated to work long hours, late nights and weekends too, without anyone knowing about it. The community, employers and parents need on the one hand to know what it takes to educate children properly, and on the other to be able to judge how well it is being done. In the long run such openness can only benefit teachers but it could make schools harder to manage and will require the development of new expertise.

The management of open systems calls for much more delegation of responsibility and much more communication than that of closed ones. This means that teachers will have to accept the development of their role as managers. They must consider themselves less as the subject specialists for which they were trained, and more as managers of learning experiences with a view of the whole curriculum. In any school, teachers are managers of people, resources and time. There is a considerable difference, however, between developing these classroom management skills, and managing learning experiences and movements of people involving regular outside contacts. Nevertheless this does present teachers with exciting possibilities for their professional development, which is currently hard to achieve through more conventional promotion.

Such staff development requires training, particularly in skills such as team leadership, planning, delegating, negotiating, managing relationships, control and review. There are no off-the-peg training solutions which will give everyone these skills, nor should their acquisition be seen as another academic discipline with the emphasis on understanding the theories of management. They have to be acquired through experience, and in-service training needs to be appropriately experiential.

Many companies have developed management training courses based on learning through participation and experience. The training staff involved in planning and running these courses have much to offer those wishing to do similar things for schools. Increasing numbers of heads and senior teachers have been on such courses, with very positive results. These range from appreciating how they perform their role as managers to seeing the relevance of modern industrial training techniques for developing new learning strategies for their pupils.

This is yet another way that industry and commerce can help education and reinforce their mutual interdependence. This has been the main theme throughout this paper. Industry needs education to change if young people are to be better prepared for working life, whatever form that may take in the future. Education needs industry to support it in the debate with those for whom the urgency of the need for change is not yet so apparent. Education also needs industry's direct and continued help in bringing about changes and in sustaining the new community contribution to the education process.

9

A Local Education Authority Perspective

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Director of Educational Services, Bradford

Having listened to some, though not all, of the previous presentations due to the fact that I have had to rush back, at intervals, to keep an eye on the shop, I approach this session with diffidence because I feel that most of the things have been said far more expertly and at a much higher intellectual level than I shall achieve. Also, I am going to tackle it from a rather different standpoint and in a different way and we'll just see how it goes.

I was listening to *Kaleidoscope* the other night, and they were talking about a *son et lumière* presentation at the Horseguards. The time came to talk about Lloyd George and they said, 'of him it was said he could never look at a belt without the urge to hit below it'. Now in some ways I feel as if there have been a number of body blows to the topic already and I am not going to be able to add much more. Particularly Chris Marsden's talk, which I enjoyed thoroughly, struck a lot of the chords that I shall hope to touch upon. So I do feel as if I'm re-arranging the chairs on the Titanic a bit; but here goes.

In Bradford we are one of the pilot areas for the TVEI schemes but I could easily have said, and it is perfectly true, that in Bradford we are also one of the pilot areas for the slow-learner projects which the Secretary of State launched a year ago — which we now call the Skills Foundation Course. I could have said we are one of the authorities taking part in the minority language survey of areas where there are different ethnic minorities. We are also one of the research areas for work into mother-tongue teaching, again for minority populations. We took part, or we have just finished taking part, in a book flood experiment which actually saturates certain schools with all sorts of books and leaves others on normal allocation and sees what happens to the children. We are one of the lead people for the West Yorkshire language link for industrial training for people whose first language isn't English; and so on. Now I don't list these in any sense to say that Bradford is different from anywhere else. I do it simply to say that if you run a local authority, the professional part of it, you really have to be geared these days for change; you have got to know what you are about in the world as you see it. Your colleagues have to know whether something new which is emerging either locally or nationally fits in with what you are trying to do and then be ready to respond to it. That is why it seems to me my talk should be devoted particularly to ways local authorities ought to be able to respond when initiatives such as the TVEI appear. So in the following outline I shall hope to indicate how an LEA ensures that it is alive to the right issues; whether it is ready to promote change when such change is judged to be appropriate; and why to us, at the time, the TVEI proposals seemed ones with which we could go along and indeed hoped to take part in.

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*Editor's Note: Richard Knight's contribution was recorded at the conference and the version printed here retains much of the narrative style of his talk.

Why, however, should there be curriculum change, which may also mean structural change in your institute or your organization? Well, I go back to Alvin Toffler who said all education springs from some image of the future. If the image of the future held by a society is grossly inaccurate its education system will betray its youth. Now I do not believe that we should accept this absolutely, for if we did we could argue that since society has been changing constantly, and education has often had to adjust retrospectively because it has not always forecast the future accurately, education has been nothing but a long series of failures. I don't accept that, even though there may be some element of truth in relation to some parts of the post-war era. One thing we do accept, though, is that society is changing and in those circumstances education must not betray its youth.

Toffler exemplifies this statement with the example of an Indian tribe living on a river bank, as it had done for centuries. It lived off everything that was round it and it therefore simply brought up its young men and women in the same way as it or the elders had themselves grown up. If unknown to the tribe somebody dams the river 200 miles away the tribe is faced with a catastrophe when the water dries up. This is what he is asking us to be aware of and not to betray our youth by not recognizing signs of change when we see them.

So we must be aware of changes, and in a local authority who do I mean? Well, I mean the service delivery points and I use that term because most local authorities, and ours particularly, run more things than just schools; though schools take up most of the budget, the other things that we run tend to be supportive of the learning process in one way or another. If I put it to you this way, we have something like 90,000 — just under — children in our district; they are captive clients, nearly all of them; they have to be there; but we probably have over a million other patrons of our services. The bigger proportion in fact are voluntary; they choose to go for a swim; they choose to use the art galleries; or to borrow books; or indeed to attend Adult Education activities in schools and other places or to take other further education chances in our colleges. So when I ask who must be alert to changes, I mean all the providers of facilities which offer and enhance the learning process. Even if I am simply talking about the facilities in a sports centre which enable people to go and pursue rather ordinary physical activities it seems to me that it is more like a learning activity than any other of the council's services.

Secondly I mean the elected members, who may have different reasons for needing to be alert to the environment, but nevertheless have to be aware of changes. Thirdly, I mean the professional staff in the centre, and just so that you know what I am talking about, we employ 15,000 people of whom 370 are central office staff. I am told that this roughly means that two out of every hundred are backroom boys devoting all of their time to seeing that the service-providing end is functioning. That is their day-to-day role, but of course the more important one is the planning that we do for medium- and long-term developments — and recognizing the trends that we have to pursue. That is why I think really that the central core of people have as important a role as anyone to play in recognizing changes. So I would expect (and this is important) not just the senior staff to be talking about these things, but supporting staff whose functions are mainly clerical ones, to have some idea of why we are talking about them. It is important, is it not, to someone visiting our central offices to encounter a receptionist who shows some interest in what is being inquired about and can be helpful to the client.

Well, we do have a system of concentrated officer groups — people whom we extract for specific tasks; it is the only way we can do this. We were not staffed in 1974 to do other than simply provide a service, and most education authorities will tell you this. We were not provided with adequate research staff and we were not provided with people to monitor things and to plan financially on the scale we have had to do since those days. So what we have to do is to let some part of the service reduce to allow other parts to look to the future; and this is how we operate. We have a number of these task groups going at any given time. The one that carries the most punch at the moment is the one looking at next year's budget; it ever was thus, and the need to keep in touch with it accounts for my absences. There is a marvellous quotation from *The Corridors of Power*; you remember there was a civil servant they kept trying to sack, and every time they set up a meeting to sack him he was there sitting, waiting, and when asked why, he said, 'When your future is at stake, be there.' So we were very seized of the technological revolution, which, as a colleague says, replaces manpower with machines just as surely as machines replaced horsepower 200 years ago.

We concentrate on this when we are able to do in-service education, not just with central staff but in conjunction with, and supporting, front-line people and of course the teacher INSET programme is the most important thing of any, not just for teachers. It is important that the administrative staff join this so that there is a confidence between the two.

While there has been a decline in employment, the national population decline has not happened in Bradford to any marked degree. How do you operate in a district which is in a country where the population is falling rapidly and all systems for financing things and planning are on that basis? When you are not typical, this means a very great deal of extra work because you have to represent your case whenever something average is being promoted. We are very aware, and this won't surprise you, of things like sex- and race-equality; and of course other industrial relations and employee legislation all press in on us and have to be taken into account. Also one has to have an organization that can react when there is an event like the Ruskin speech. What tends to happen is that we read these things in the paper, and it becomes canteen gossip; but do we do more than that? You have got to have a system which will pick up things like this and know what people outside your immediate circle will make of it, so that when you are asked what you think, your organization can speak with some confidence and consistency.

Reference was made earlier to my time in the West Riding: that time threw up many memories but one significant thing was that it was over 125 miles from the north-west of it to the south-east of it. You could go into a school in Sedbergh and converse about something one day and you could go into a school on the south bank of the Humber the next day to discuss the same thing. The achievement of that organization was that the same issues, the same perspectives, would be voiced by teaching staff in both places. I think that was its big success. I don't know how it was achieved. I wish I felt I was getting somewhere near it in my own authority. I think, just occasionally in the 1980s there are places where this is so and what that says is that the relationships have been rebuilt after ten years of upheaval and we are beginning to get back to that sort of freemasonry of ideas which is terribly important.

We have to question, don't we, the supreme value of passing on the wealth of knowledge of the past, which is what western education systems have done, and recognize that this is being superseded. The need to tool-up for the future causes us to question whether we're dealing with the higher intellectual levels and providing for them only, or whether we ought in fact to cut right across all those historical divisions of education provision to enclose a wider, new range of clients. If I go back to my own base again, and the multi-race issues, the trouble is when you do something quite new then you become a point of other people's interest. You may have read that we had five schools that a Muslim group wanted to take over. This was resolved recently, but now the case history of this, which we have written carefully, is already being requested by about ten different places.

This business of local initiatives is time-consuming for local authorities. Many of these are significant curriculum matters. They find their way through in-service programmes into teacher dialogue where they are starting points in the discussion. Someone has to wave the flag and start them off. So one asks, are our delivery mechanisms flexible enough to handle change rather than static things that want to take anchor at a given point in time? And it is interesting that some schools which ten years ago I remember being in the forefront of experiment and interesting developments may not have advanced from there. They had, as it were, a flowering and, having then disseminated what they had to offer, other schools have taken over as the lead schools in these things. It is Toffler again who warns against basing the image of the future on experience of the present. There is a massive danger if we do that, of failing to forecast the future adequately. We must ensure that the mechanisms that we develop can take on board future predictions.

How can we retain motivation and interest in our young people? Youngsters used to be rebellious. That is not the story I hear so frequently these days — yes, there are children who kick over the traces, but what I hear more about is apathy. This frequently comes to the surface. We must take this on board and recognize their dissatisfaction with the curriculum.

We must accept, too, that the curriculum is not a front-end loading process but it is the first stage in an on-going life process. This explodes, does it not, the whole business of the body of knowledge. I struggle a little when I hear that we are being encouraged to return to traditional standards and values, when the employers that I do talk to say, we do not want people with obsolete skills, we want to change the curriculum. We have contacts with firms whose interest continues because they can see what they are telling us is being reflected in curriculum change and that, although this only affects a small part of the total curriculum, it is most encouraging. But who is right? It does seem to me that employers who are quantifying their needs are sooner or later going to come up against the fact that the traditional curriculum may not meet them and I shall be an interested bystander at the debate that will then occur; maybe it is occurring already. It must provide survival and adaptation skills for life styles where work is not the norm.

I am told that there are something like 22½ million jobs, which is more than there were immediately after the war when there were jobs for nearly everybody; but there are many more people who want to work now. Has the educational system recognized that factor and adjusted to it? I do remember being segregated in the mixed school I went to — the boys sat on one side of the room and the girls on the other, while for much of the week we followed different timetables — the Equal Opportunities Commission would have had a field day — but that was on the assumption that girls did not need certain things. Now there really ought to be 40 million jobs or thereabouts, and the education system must adapt and be ready to meet retraining needs for those in employment as changes occur.

We have to be ready to recognize not just what the curriculum has to produce but what the external pressures for change are. One of course is industry and employers. The Ruskin speech was one: likewise the two Education Acts of 1980 and 1981. We run a three-tier system. There is complete opportunity to express a choice. It doesn't mean everyone gets their choice, but over 90 per cent do. And it means (and this came out of the 1980 Act) that youngsters proceeding to an upper school could well have been to any one of a dozen or fifteen middle schools, while the children at the middle school could well have been to half a dozen or more first schools. But if you look at the child at five I would think he's only got maybe 50 per cent to 60 per cent choice of proceeding right through the same pyramid as the bulk of his/her peers to the upper school; which means that if you are trying to reinforce a continuous curriculum, however it is expressed, you're only going to give the best on offer to half the youngsters in any given area. When parents question the implications of this I have to say that freedom of choice and the achievement of the best educational offerings are virtually incompatible. The democratic decision that allows parents rights in this way is not something that I am going to quarrel with, but if it is so, let us recognize what shortcomings that brings. It is very difficult for a parent whose child fails to get the first or second choice to even address that part of the argument. But legislation that creates these situations is an external pressure for change.

It's interesting to note that one of the most successful groups of teachers to ensure that in spite of these handicaps there is a continuity of provision are the craft, design and technology teachers in Bradford. This is because they are a relatively stable group. They are recognizable in the sense that they do have a fairly precise defined curriculum area to be responsible for. We are lucky in the facilities we have. We owe quite a lot to Geoff Wilson because he pioneered them and they came to us on re-organization. We have always had energetic advisers who have gathered those teachers together. But what parents can know is that at any given stage of transfer certain principles are being covered even though the choice system means that a child won't necessarily go through schools in the same pyramid.

New exam systems; well, I will say more about that later because I think that exams at 16+ are dying things. YTS and TVEI; changes in our provision for ethnic minority groups where a reassertion of cultural maintenance and language preservation is important as part of the environment. Important because best educational practice surely looks at the environment, starts from there and then spreads to other less familiar things; so if there are three different cultures feeding one first school one must use this. Parents, particularly. Education administrators who do have ideas which are their own. Teachers also. We have to be ready to respond to all these pressures.

'Who are the participants?' is the next thing one wants to know. Are these pressures exposing people with whom we must combine and should combine, in demanding, in providing for, and then evaluating change? Firstly, there is the range of people referred to in the Taylor Report, who were listed as being important parts of governing bodies. Secondly, people I have described as catalysts. There are bodies that do change things from outside, like the MSC, like new curriculum and exam bodies. Thirdly, universities and research. The value to me of this conference is being reminded how important it is to take note of what research is telling us. It would be simple each morning not to plan the day but just to sit and wait for the flak to hit you. In such circumstances the last thing one does is to read the really important things that can get you forward in your thinking. What, of course, one does is deal with those bits of research which one can't ignore because there are related issues in one's authority. So I read what Alan Little tells me about dealing with minority groups. I read very much what's going on in the unemployment front because the prospects are so dire where we work. One needs to know precisely what

Government developments are still at the green paper stage — so local authority officers have to take part in national things because the national mood is crucial in many ways. In others it's a question of detecting new things that occur locally, and disseminating them. I'm afraid I take issue with Professor Layton here. We do need a national lead at one point, but I don't think you can have such a lead until you have identified something — a new development to push. So I still do think that where one sees individual teachers developing things at a school where sound innovation is fostered, then that's your growth point. And that's, I think, where also a dialogue with universities must increase because their research can support such work.

Fourthly, the local community. In recognizing that a wider society is going to have a say in educational priorities, we must also recognize that the work-related curriculum — or should I say, the occupation-related curriculum — is going to be ranked and prioritized according to society's value of particular personal occupations. There is a series of questions which we then have to ask ourselves. A whole range of local people, employers as well as local authorities have, it seems to me, to try to find answers to certain questions. They must accept, firstly, that there is an increase in the proportion of the population for whom work will not begin before 18 or 19 if it starts at all. We really don't have to ask ourselves the question about how far traditional manufacturing industries will decline, it's happening all about us; the question which Professor Tom Stonier is always asking — what will the balance of occupations be? — offers the quick balance of 10 per cent producing and 90 per cent thinking of better ways to do it! What is difficult to unravel is how we get from here to there. But it's a fair question and I think it's valuable that we have on our doorstep a university that finds room for someone like that, who is willing to come down and talk to the half dozen senior staff in our office for a whole morning and swap punches over these sort of things, because it helps us to come to these earlier questions.

Then there are the things that worry young people whose views the Thompson Group helped to check by commissioning a marketing firm to research. We set them to work on young people's views because we reckoned we were inhibited, being educationalists, and they did in fact first say to us — well, the passport that work provided was self-respect and a stake, a role in society. Because of that we said that they needed to have political education with a small 'p', how to handle themselves in groups, because what they wanted was to influence and criticise their youth club from within. They felt they needed the status that a job and some money gave them as well as their parents' respect which came with the job; to be legitimized in society. The money wasn't very difficult — there is no problem about getting money — I didn't enquire too deeply into that, but it was the status that mattered. And it then follows that society's perspective of jobs, society's perspective of occupations has to change. If our young people don't get a different perspective, they'll just be embittered as many of their parents are. And the values we place on occupations which may not be those for which we pay salaries, and the recognition by society that's in work — you don't need to tell the sector that's out of work that there is this change going on. Then, having recognized the differences, to learn to live with people in it who may not have the same occupations or values as those of us who have traditional jobs. Young people need to be valued for their own qualities and not for some status that the jobs might carry with them. I have spent a little time on this because it does seem to me that unless we keep up the communication with young people, all the TVEI schemes in the world are not going to achieve what we hope they will.

I commented earlier about the relevancy of exams. I really do think that if the school leaving age is rapidly going to be 18 *de facto*, what we examine at 16 will be really like an internal end-of-term test. It's not going to carry much currency outside. One of the successes of our own Careers Association is a personal record that youngsters keep. Now some of the contents might not be of interest but there will be something in it of interest to all potential employers. Indeed, it's been created in part by employers saying what they need and the printing and production of it has been funded by some of them.

If we accept Tom Stonier's forecast of the balance — 90 per cent of people trying to think of ways of helping the 10 per cent to produce things — then the relevance and effect of government intervention becomes much more significant. If we add together what the MSC puts into training and what DES is normally responsible for, we are doing what Tom Stonier said, as a nation. We are gradually increasing the proportion of money spent on personal development. The government is voting increasing resources to this. The question really, then, is what is the nature of the contract to be between central government and local government; between central professional initiatives and local ones? The 14-19 sector exemplifies a need to clarify this. One of the things that's going to happen is that with TVEI, YTS and curriculum changes generally your 14 year old is really going to be looking for the right place to follow his or her programme, or course, rather than choose a particular school. It would be right, if the right course happens in school, for you to spend most of those four years there. But it might be better for you in a youth club or college, or some kind of skills training centre. And I honestly do think that we shall see a de-schooling, or rather a breakdown of all traditional barriers post-14. We are lucky in Bradford because we didn't move to sixth-form colleges, but kept to 13-18 schools. We are poised now to respond to things like TVEI because we have a structure that can do that. We have gone a stage further actually because we've linked groups of schools with one or other of the colleges and so we'd already got consortia with course options between institutions, for youngsters to decide about at 14. More particularly we were doing it at 16, but the framework is there now. There is a further possibility, if the media are available to you. We have a radio network now but one might even have a television education station which encompasses the whole district. We could provide our own distance learning programmes so students might only need the educational institution as a tutorial resource once a week. Also this can extend beyond 18. So there are many possibilities. The first thing we have got to do though, is to break down all the barriers that we have had post-14. I think it will come one day. I am not sure if it will come in my day.

There are two other curriculum questions that I would like to refer to. First, I do think it is important to look at issues which are cross-curriculum ones. The reason why I asked that we circulate the SEO occasional paper relates to this.* I particularly want to home in on the first of the three issues covered there, which is education for enterprise, because it raises a number of cross-curriculum issues. Not all teachers accept that these should involve everyone. But, however much they train for a particular specialism, when they get into a school community which is a learning one, they become a learning resource on a whole wide range of things. I would say these include English or communication skills, the general business of creativity and this matter of enterprise skills. We have done very well since the war in getting young people to ask the question, 'why?' In a way, one gets very worried when one sees social disruption but in another way it is a form of asking why. Now that never happened before the war. Having reached that situation, though, we've not solved the question what do you do next when you've asked the question 'why?' Will you take responsibility for the next step? And I think education for enterprise is one way to begin to make people aware that they have to move to the next stage. I quote from the top of page three of the paper which says, 'at the most general level education for enterprise should be for all students and children. It should develop in all students at least some of the skills and attitudes associated with successful enterprise. The idea of nurturing a selected group of potential entrepreneurs may have some relevance for adults but in compulsory schooling and general vocation preparation the first priority is to create the conditions and learning experiences in which, from an early age, children and young people can begin to understand and appreciate the value and challenge of business enterprise.' There are first schools that I can take you to in our district where the creative talents of youngsters that are tapped in the lead-up to the use of computers have to be seen to be believed. Now those youngsters have no inhibitions. They show an important quality that will be valuable post-13 and they are asking questions more related to industry. They seem to be able to use creative intuition, and I don't think we've given enough credibility to this. The creative things that happen in school are just those things which allow youngsters to guess and to take chances both in physical ways and in intellectual ways and I really do think that these should be the responsibility of all teachers.

I want to go on to the last section now, in which I examine the balance in more detail between central and local government. I've said what could happen to the post-14 situation but what does that mean? It means, I suspect,

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*Society of Education Officers Occasional Paper — Number Three. *Key Issues for Industry and Education*. Published by the Society of Education Officers, 5 Bentinck Street, London W1M 5RN. (25p) that the provisions which have come out through MSC as originally unemployment-related provisions like YOP and YTS (though this has moved on from there) and initiatives such as TVEI, are going to come closer together because we are dealing with the same group of clients. If we are going to expand TVEI so that over half the authorities in the country at least will have a taste of it and YTS reaches its targets right across the country, then the youngsters will talk to each other and look for the best buy. The deciding factor then is more likely to be financial rather than curricular. I shall look at the implications shortly. Meanwhile the two initiatives have come direct from central to local government, they have by-passed the ponderous committee and civil service structure that I mentioned earlier. It must be attractive to central politicians to get delivery of their ideas that way, because TVEI, as I see it, is a contract between the central politicians who want to change things and the local service delivery agents. MSC was the best vehicle to use. Now, however one argues about this, it is what happened. The question for me is, how necessary is the local view?

When we looked at the criteria originally in the Steering Group, we found the need for modifications. These come from people who said, well if you try and do that on the ground it won't work, so let's modify the criteria; let's look again at some of the guidelines. There are certain things which are just going to lead nowhere — while others look right. The debate happened between people with control of things at the centre, with political priorities and the money, and people with direct curriculum experience and control of delivery mechanisms.

This was a fascinating exercise — look how quickly it got off the ground. I don't know, but I would have thought that it was as efficient in its mobilization as most industrial things have been. I mentioned to some of you that we ended up in our pilot project with the most substantial building project of any of them. Now, we didn't know we were going to be a pilot project until the end of March; and we took over £500,000 worth of building last Friday, 2 September. I would have thought Marks & Spencers would take as long as that to do it — so you *can* achieve things efficiently.

But if that seems worthwhile it will be attractive, won't it, to say, well this central collaboration is worth developing. I wonder whether we are witnessing the beginnings of the joining together of MSC and DES? In saying this, I'm not giving a view as to whether it's a good or a bad thing, but I'm wondering whether it will happen. And if it happens, what's going to happen locally? Are we in fact going to be faced with then somebody saying, oh, well, what are the control mechanisms locally? There is an area board system for MSC with YTS, an elected education committee through the council on the education side. Will it not be tempting to see if some amalgam of those two functions and accountabilities can be worked out? If so, where does that leave education *vis-à-vis* local government? If this does gain momentum then without some form of local accountability, however embarrassing that is to the central systems, you really don't get local commitment. It does seem to me when I talk to colleagues in the health service, or indeed the police, that there is a very different concept of how one relates to the environment and the people in it. In the education field there are elected people with you all the time and most of them have a stake in the community, a direct stake. So I think we are on the threshold of a fascinating debate.

Separate from this, I felt it would be useful to say what happens when we decide to mobilize a bid for a project like the TVEI. I can run through these, but I suspect they will only be of interest to some of you. If it is, perhaps it will come out in questions — such things as, how you get political cover for it? How do you get your own staffs, those of the schools and the colleges, working together all the time? How to get quality control among the planning? All those things have ramifications for us which mean sacrifices elsewhere. They do! We had to take people off other work, and certain things didn't happen; as well as receiving half a million pounds worth of building last Friday, some seven or eight other schools couldn't open this Tuesday because building works on them weren't up to date — they are only going to be two or three days late, but this is the cost! There is a considerable checklist of administrative action which shows how those of us operating in the local authority sphere with elected members and different professional colleagues need to mobilize for change.

Question: I wonder if Richard could go through the checklist, partly to further illustrate the relationship between central and local government, but also because I think what you have to say, and your experience, should be of general interest in view of the fact that so many other LEAs will soon be bidding for TVEI money.

Reply: Well, I think I had a unique advantage because I was a member of the National Steering Group at the same time as colleagues were putting together our submission; while people will say it gave a certain built-in advantage, there are two colleagues here who will tell you how much they saw of me during the whole of the time, which was precious little. But the first thing we had to do was to decide whether the issues that I've been through in the last fifty minutes as far as Bradford was concerned would be enhanced by the initiative. We had to decide if this was for us, if it's in line with what we were thinking. For a whole lot of reasons and not only the success of the CDT things that were going on in the district, it seemed right. The consortia system was right, it was working; we had been giving thought to specialist courses, post-16 and pre-16, and we had members interested in all of these things. For a whole lot of reasons we thought it was right. So then we had to identify the priorities for our service for that period. Not only did I have to take myself off a lot of things to take part in the Steering Group, but I had to take one section of the office, advisors, administrators, out of their normal work and get other people to cover for them, and of course mobilize staff at the school/college end. I've only been told what had to happen at institutional level but it did really mean changes; the creation of a sweatshop or two into which people disappeared to think and plan. It must have meant massive communication issues with the rest of the staff because the timescale was such that they had to take a lot of innovation on trust and do the persuasion and explanation later. We did need to check very carefully our existing base line, because it wasn't as clear until we were actually nominated as a pilot project whether it was going to cost us much; it wouldn't cost much simply to take the guidelines and try to add new things. What was it going to do to the existing cohorts of youngsters in those schools? What was it going to do to the other services?

We had to take a massive chance by asking a firm, for no reward, to undertake feasibility studies of the thing before we even knew we were likely to be chosen. And having done that, we then had to get exceptions to standing orders from elected members who had only approved in principle the idea of the submission, which brought in a whole lot of other people, from different sub-committees, who weren't education committee members. This needed exceptions to standing orders so we had a massive exercise with elected members and with professional staff. You have really got to know whether the rest of your in-service education programme is asking the same sort of questions of teachers. I should explain that our in-service system has somebody in each school who says annually what that school thinks is important. This does result in an annual in-service programme being established, at least some of which has teaching priorities built into it. Now if that's way out of line with what the initiative requires, you know you'll have trouble with the people you are going to ask to deliver it.

It depends too on the nature of your secondary and tertiary systems and we have our consortium already. Then staff morale is important; I think I was saying earlier that one looks at schools and asks whether they have a curriculum or simply work through a timetable. If the school has thought about what it is offering, so that it's a cohesive curriculum, where one can assume that most teachers understand not just their bit but other people's pieces, then they are likely to react favourably to initiatives of this sort, because they will know of gaps and they will see this as a chance to fill them and advance. But if they are simply going through the motions, then one has to say no, it seems to me. There are some nationally promoted things we just haven't attempted. For a valuable check, I think personally that with young people in their teens one must go back to the Youth Review's findings of young people's aspirations. There are two documents: there is the Review itself where Chapter Three explains in no uncertain terms what young people think of life round about them, and what the issues are. It rehearses the educational view of how young people learn. And also there is another document now which summarizes the views received through the survey. I really think they are very important.

Then there are the buildings. I would want to know whether schools have the same ethos as they had when they were built — most of ours are 100 years old — or whether they have tried and succeeded in taking on board social and academic advances. We must judge how far teachers are equipped to take on new roles and priorities and then what other learning resources are to hand locally, regionally and nationally. We're using two universities in relation to the various aspects of TVEI. We have to assess the value of community strong-points, the local mosques, the recreational facilities throughout the system and the careers association links with employers: we need schools to tell us whether the governors and parents can cope with change like this and take on board the responsibilities it implies. Because we have an elaborate system each year for budgeting, can we work an initiative like this into the budget? It may mean that the in-service side of it has got to be re-jigged quite substantially because the priorities will change. And then as we also run libraries, recreation and the art galleries and museums it is important that they are informed properly.

Briefly, it is important to take all the specialist sections into a development like TVEI because they may become a significant contributory factor as the project develops.

10

The Technical and Vocational Education Initiative

John Woolhouse
Director, TVEI Unit, Manpower Services Commission

One of the objectives of TVEI is to stimulate informed debate about the need for change in the curriculum of 14 to 18 year-olds and to explore means by which those changes might be delivered. The fact that since the initiative was announced in the House of Commons in November 1982 some fourteen local education authorities have taken steps which have enabled about 4,000 young people to start in September 1983 on a modified and enriched curriculum is evidence that the education service can respond with commitment, speed and confidence when provided with the necessary resources.

I want to touch briefly on five perspectives about TVEI. The first is a historical perspective — TVEI in the context of past developments; the second is TVEI and the twenty-first century, TVEI and the future; the third is TVEI and young people; the fourth is TVEI and the community; the fifth is TVEI and some aspects of the international scene.

Beginning with an attempt to place TVEI in a historical context, I should like to quote the following statement by a Royal Commission: 'We are bound to point out that our evidence appears to show that our industrial classes have not even the basis of a sound general education on which alone technical education can rest. Unless we remedy this want, we shall gradually but surely find that our undeniable superiority in energy and in wealth will not save us from decline.' Many of my colleagues will recognize that quotation from the Royal Commission of 1868, which had completed a series of visits two years before the passing of Forster's Act and which was gravely concerned. That concern arose, admittedly, on a different scene and at a different time, but many of the concerns were not altogether different from those which some of us have about the changes going on in society now which are likely to accelerate and continue, certainly for the rest of this century and well into the next.

If one wants to look at that view from another angle, one might reflect that Trevelyan in his *Social History of England* said: 'Without the Education Acts of

1870 and 1902 England could not have competed in the coming arena of machinery and organisation and her people would have sunk into the barbarism of an uneducated city population.' Again, the circumstances have changed, but many of the authorities which have supported and are intending to support this initiative are concerned about the same theme — changes in society, changes in the community. Many of our urban communities are of course gravely concerned about the nature of that community in a post-industrial society, and a society which is changing rapidly.

If you feel that that is enough about the nineteenth century, let us come up to 1982. If we move on one hundred years, there is a quotation from a book published last year which I think is highly relevant to our discussion today: 'The school curriculum must endow all pupils with a sense of their own competencies. It must draw on a wide range of community skills and abilities, so that all children can derive from their education a realistic sense of their own strengths and weaknesses; and this must be achieved within a strong spirit of corporate solidarity.' Again, many of my colleagues will recognize that quotation from David Hargreaves' recent stimulating book *Culture, Curriculum and Society — the Challenge for the Comprehensive School.*

So the debate of which TVEI is part has gone on for well over a century. It has been expressed in many different forms, but it has as a common theme the response of the education service to changing needs. It is worth reflecting that if you accept the argument that this debate was going on in the latter part of the nineteenth century and that change in education cannot be achieved overnight — that it will take five, ten or fifteen years for the full implications of what we are doing to be understood, judged and, if they are right, replicated — then in a very real sense we are talking about the education service in the twenty-first century.

The second round of TVEI, which is due to start with additional local education authorities in September 1984, will not be completed until the end of this decade. If they decide that they wish to go on developing at least some of the changes and initiatives which have been developed during that period, there is no doubt that it will be around the year 2000 before it is possible to do so. Therefore, it is with the needs of young people and communities in the twenty-first century that we are dealing.

I wanted to say something about TVEI and young people because sometimes the discussions and reports about this initiative make it sound as if it were a debate between teachers and educationists. One must constantly remind oneself that this initiative will be judged in the end by young people and their parents, by the options they exercise, by the interest they express and by their achievements, whether in schools or in subsequent education.

In that context it is worth bearing in mind that we are dealing with a large group of 14 to 18 year-olds who until 1947 were outside the period of compulsory school education. We have had only thirty-six years since the raising of the school leaving age above 14. We all know that we are dealing with young adults with a degree of physical maturity, independence and challenge, and not with children in the sense of immature people aged from 5 to 14. For much of our previous history those young adults would in the main have been engaged in the working life of the community at that age. It is not, therefore, surprising to find that the interests of many of them are in things which are relevant, which bring a sense of achievement, which can be seen to relate to the world outside school. One of the themes running through this initiative is the aim of generating interest, of motivating, of stretching and challenging people who are indeed young adults, while they are learning about the community and the world of work.

My fourth perspective — TVEI and the needs of the community — can be expressed of course in many different ways. The concern of our predecessors in the nineteenth century about the need for a technically and professionally competent workforce is a very important dimension of TVEI, but it is not the only dimension; it is not just about people for industry. In fact numerically it is more likely to be about people for business and enterprise, as I shall try to show. It is not just about commerce and industry: it is about the future of our public services and our ability to maintain the education service, our health and social services; it is about the richness of our communities and the ability to generate creative abilities; it is about media studies and about the performing arts. Therefore, it is about the community in its economic dimension, about the community in its system of caring for its population, about the community as a place in which people live and express their values and thoughts. When we consider the needs of the community and the relationship between this initiative and community development, all those dimensions are important and all are to some extent reflected in developments taking place in the initiative.

At this point, I should like to remind anyone who has not been closely involved previously with TVEI what the aims are. The full statement, as set out by the national steering group, is given below.

AIMS OF THE TECHNICAL AND VOCATIONAL EDUCATION INITIATIVE

(a) In conjunction with LEAs to explore and test ways of organizing and managing the education of 14 to 18 year-olds across the ability range so that:

   i. more of them are attracted to seek the qualifications/skills which will be of direct value to them at work and more of them achieve these qualifications and skills;

   ii. they are better equipped to enter the world of employment which will await them;

   iii. they acquire a more direct appreciation of the practical application of the qualifications for which they are working;

   iv. they become accustomed to using their skills and knowledge to solve the real-world problems they will meet at work;

v. more emphasis is placed on developing initiative, motivation and enterprise as well as problem-solving skills and other aspects of personal development;

vi. the construction of the bridge from education to work is begun earlier by giving these young people the opportunity to have direct contact and training/planned work experience with a number of local employers in the relevant specialisms;

vii. there is close collaboration between local education authorities and industry/commerce/public services etc, so that the curriculum has industry's confidence.

(b) To undertake (a) in such a way that:

i. the detailed aims can be achieved quickly and cost-effectively;

ii. the educational lessons learned can be readily applied in other localities and to other groups among the 14 to 18 year-olds;

iii. the educational structures/schemes established to further the aims of the initiative should be consistent with progressive developments in skill and vocational training outside the school environment, existing vocational education for under 16 year-olds and higher education;

iv. emphasis is placed on careful monitoring and evaluation;

v. individual projects are managed at local level;

vi. the overall conduct, assessment and development of the initiative can be assessed and monitored by the MSC and the TVEI Unit it has established for this purpose.

All the aims listed under (a) are already being pursued. The majority of the seventy schemes submitted by sixty-six LEAs in response to the invitation last January show a common theme — that the aims, and indeed the criteria, of TVEI reflect what we have been trying to do for many years. There are, however, some points worth emphasizing. The second aim is that young people are better qualified to enter employment — for which I should prefer a wider expression. We are looking not just at employment but at public service, at self-employment and at activities in the community. Although 'employment' is a way of expressing that aim, it could be more widely expressed in the context of the kind of society we want to see.

The third aim is that young people should understand the practical application of what they are learning. Those of you who have been committed for many years to a more active approach to learning will recognize, as you will in everything else in this initiative, that it is not about new or revolutionary ideas but about the bringing together of ideas which have been around in the education service for a long time. The fourth and fifth aims — that young people should become more accustomed to using skills and knowledge to solve real problems — are reiterations of that theme.

The sixth aim is that there should be a better bridge from education to work through planned work experience and in many other ways, including the whole approach to the curriculum, both in terms of its content and of teaching and learning strategies. The seventh is that there should be close collaboration between the education service and the world of work and the community.

The qualifications to which reference is made in (a)i are combinations of both GCE and CSE subjects, of BEC and TEC qualifications, of City and Guilds and RSAs and other professional qualifications. We are all aware that the examination as it stands in this country does not adequately reflect the needs of a large proportion of the school population. Therefore, there is a difficulty in curriculum development for those who are seeking to achieve the objective of widening and enriching the curriculum and at the same time helping people to achieve qualifications which are recognized in outside society, in that those qualifications themselves may not adequately reflect achievement. It is for that reason that great importance has been placed by the national steering group on the use of records of achievement and periodic records of progress as some contribution to the need to widen the debate about the way in which we describe educational achievement and the acquisition of skills and competence.

There are a number of principles underlying the initiative, which again are familiar to all of you. First, the initiative is about a partnership between Government and LEAs, that partnership being reflected in a contract drawn up between them. Second, projects should adopt different forms according to different local circumstances. The national steering group has always recognized that differences in communities across the country — differences in starting positions in schools, differences in the level of facilities and resources — must mean that each authority, and indeed consortia of schools within authorities, must try to reflect, as far as they can identify them, the needs of the community in which they operate.

Another principle is that projects may be based on existing facilities. There is particular emphasis here on the bringing together of both schools in consortium arrangements and schools and further education colleges in collaborative arrangements, as well as the provision in some authorities of additional learning resource centres for particular areas of curriculum development.

It is a principle of the scheme that young people's participation should be voluntary, as is the participation of the schools and LEAs themselves. Nobody has to take part in TVEI, unless they share the aims and objectives of that initiative and wish to join in the task of exploring new approaches to it. It is, and remains, a pilot.

Above all, it is a principle of the scheme that curricula are a matter for local determination within the criteria and that therefore it is right that there should be many different approaches to the development of the curricula across the schemes, because the whole object of a pilot of this kind is to explore different approaches; it is not to implement a central curriculum, because there is no central curriculum. The 1944 Education Act in any case requires curricula to be a matter for local determination.

I will now summarize and return to my theme of what TVEI will do for young people. The original announcement of the scheme stated these three aims for assisting young people: first, to widen and enrich the curriculum; secondly, to encourage personal development, problem solving, initiative, enterprise, creativity and so on; thirdly, to help young people to develop skills and interests, including creative abilities, which will help them to lead a fuller life and be able to contribute more to the life of the community.

If that is a description of a narrow vocational curriculum, I should be misrepresenting the spirit which the national steering group has tried to convey. It is about much wider and, I hope, deeper educational objectives in the context of a changing society and about the role of those young people in relation to the communities in which they live.

I want to highlight some of the changes which are already occurring in society, as seen through the world of work. These are of course only a tiny part of the many changes which are going on around us, some of which may be gathering speed in the period during which the young people in the initiative will be active in the community — namely, from 1990 to 2040. Because it is extremely difficult for any of us to predict what will happen — I would not pretend to be able to do so — one way of understanding what will happen is to see what is happening now and to take note of what has already happened in our society. I want to illustrate some of those changes.

SIC		Thousand	%
0	Agriculture, forestry, fishing	370	1.75
1	Energy and water supply	682	3.22
2	Metals, minerals and chemicals	891	4.21
3	Metal goods, engineering and vehicles	2,797	13.23
4	Other manufacturing industries	2,244	10.61
5	Construction	1,074	5.08
6	Distribution, hotels, catering; repairs	4,113	19.45
7	Transport and communication	1,406	6.65
8	Banking, insurance and business services	1,724	8.15
9	Public admin., education, health, recreation	5,846	27.64
	All industries and services	21,148	100.00

(*Employment Gazette Occasional Supplement* No 1; May 1983)

Table 1. 1981 Census of Employment: Full- and part-time

Table 1 gives figures taken from the 1981 census of employment, which are the most recent figures we have for these categories. You will see that about 370,000 people were employed in agriculture, forestry and fishing — 1.75 per cent, or fewer than two in every 100 of the population. In the period of the 1868 Royal Commission about 40 per cent of the economically active labour force were engaged in agriculture. That proportion has now fallen to under 2 per cent, who are producing about 60 per cent of the United Kingdom's food requirements. That is primarily because of technological change and the better use of natural resources. There is nothing new about technological change or, as I have tried to show, about the social changes which follow from it. Therefore, we would do well to reflect on the experience of our predecessors, because we may learn something from it which will help us in the task of trying to see where we are going today.

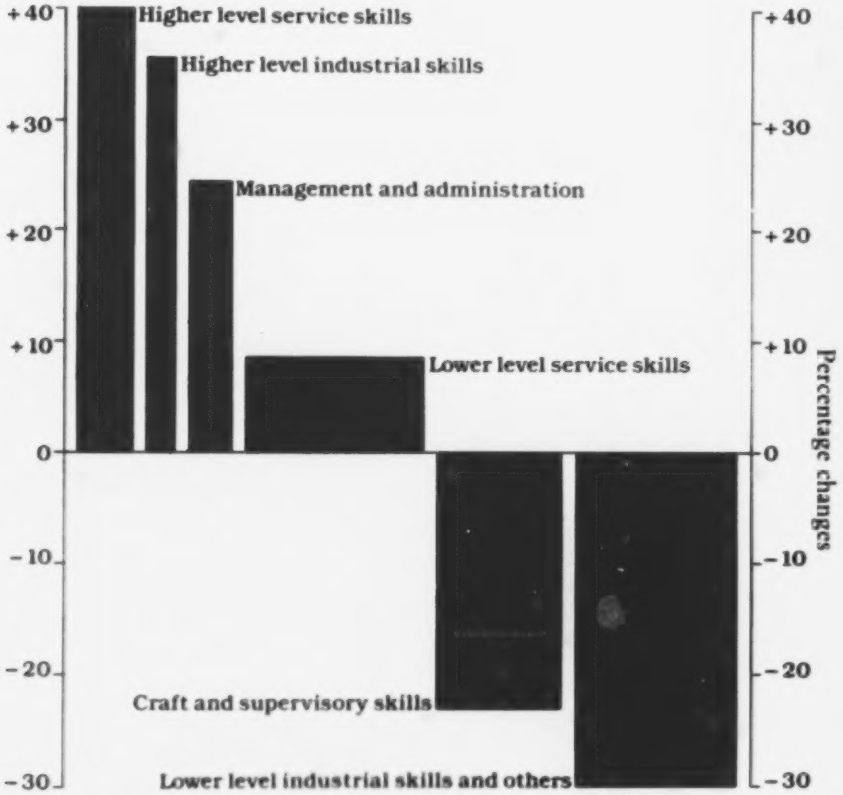
Going quickly through the figures you will see that about three people in every 100 work in energy and water supply, about four in metals, minerals and chemicals and about thirteen in metal goods, engineering and vehicles, although sadly this number is falling rapidly, partly as a result of a major shift in the balance of economic power.

It is interesting to note the recent report in *The Times* that our negative balance of trade with Japan has now reached £2.5 billion a year. Since Japan is only one, although perhaps the foremost, of a whole range of changing societies and developing countries which are making a massive investment in international and commercial fields, we are facing a period of economic competition as severe as anything we have experienced in the past, and perhaps more so. If rapid technological development is combined with a major shift of economic activity across the world, it is very likely that the resulting changes will be wide ranging and very significant.

About eleven in 100 work in other manufacturing industries, five work in construction and about twenty work in one of the major service sectors of distribution, hotels and catering. About seven people in every 100 work in transport and communication and about eight in banking, insurance and business services. Then we come to public administration, education, health and recreation. Of every 100 people, twenty-eight already work in those sectors. It is interesting to observe that if these last two percentages are added together, 36 per cent of the population are already engaged in those sectors. That is why I emphasized earlier that, although the preparation of young people as technologists and technicians for industry and professional services is an important part of the task of the education service, its task is much wider and more complex than that, involving a much more diverse range of occupations and a rapidly changing distribution of those occupations.

The information in Figure 1 (p 140) is based on the Warwick University forecasts of likely changes over the twenty years from 1971 to 1990. You will notice that Warwick's projection is that high-level service skills at professional level are likely to increase by about 40 per cent, but only for a relatively small proportion of the population. The study predicts that higher-level industrial skills — technologists and higher-level technicians, for example — are likely to increase by 35 per cent, management and administration by 20 per cent and lower-level service skills by 8 per cent. The craft and supervisory skills and, above all, the lower-level industrial skills — broadly speaking, unskilled and semi-skilled workers — are likely to decline by about 30 per cent.

Those of you who are sceptical about forecasts and models will have to temper your scepticism in the face of the fact that most of the changes shown have already occurred and that a substantial number of unskilled and semi-skilled jobs requiring lower-level skills have already disappeared — two million in the last decade. Therefore, we are seeing the continuation of a process of upgrading the levels of professional, scientific and other skills which are likely to be required in the kind of society we shall see in future. We are also seeing the very difficult situation which is likely to be faced by young people entering the labour market without some technical or professional competence and capability.



Note: The width of each bar is proportional to the numbers in that occupational group.

Figure 1. Employment by broad occupational group: percentage changes 1971-90.

The figures in Table 2 reinforce that message. They are also part of the Warwick review of the economy and employment, this time relating to 1980–90. They show the probability of increases in the proportion of managers, a slight drop in the education professions, increases in the health professions, in other professions, in literary, artistic and sports occupations, in engineers and scientists, and in technicians and draughtsmen. Clerical occupations will be relatively stable on this forecast, and nearly all the rest of the occupations show a decline. Again you can see the same theme of an upgrading of the levels of professional skill and competence. You will also see here that craftsmen, skilled operatives and almost all other occupations except security occupations are predicted to decline.

	1980	%	% change 1980–90
Managers and administrators	2,129	8.5	+5.7
Education profession	984	3.9	−4.3
Health professions	986	3.9	+9.4
Other professions	562	2.2	+11.5
Literary, artistic and sports occupations	447	1.8	+26.0
Engineers, scientists etc	576	2.3	+14.3
Technicians, draughtsmen	601	2.4	+12.5
Clerical occupations	4,056	16.2	+0.5
Sales occupations	1,417	5.7	−5.6
Supervisors, foremen	104	0.4	−10.0
Engineering craftsmen	2,143	8.6	−5.3
Other transferable craftsmen	907	3.6	−18.0
Non-transferable craftsmen	675	2.7	−27.4
Skilled operatives	622	2.5	−15.3
Other operatives	4,712	18.8	−18.0
Security occupations	386	1.5	+25.0
Personal service occupations	2,932	11.7	−3.0
Other occupations	789	3.2	−38.1
Non-manual occupations	11,755	47.0	+3.8
Manual occupations	13,271	53.0	−12.9
All occupations	25,026	100.0	−5.0

(Source: *IER Review of the Economy and Employment 1983*. Table 3.5)

Table 2. Change in Employment by Occupation 1980–90

Going on to Table 3, it is extremely difficult to make accurate comparisons between different countries in the provision of education and vocational training, because of the differences in practice and the difficulty of getting comparable figures. Nevertheless, allowing for those difficulties, this Table gives some indication of the extent to which the provision in this country compares with that in other countries in Europe, if one adds together the numbers of young people in a number of sample years who remain in full-time general education after compulsory school-leaving age or who continue in full-time vocational education or in an apprenticeship. Adding those three areas together, the figures for Belgium appear to be about 95 per cent, for West Germany about 90 per cent, for France 81 per cent, for the Netherlands 73 per cent — and for Great Britain about 56 per cent.

Country	Full-time General Education	Full-time Vocational Education	Apprenticeship	Total %
Belgium	55	36	4	95
Denmark	23	13	30	66
West Germany	21	19	50	90
France	27	40	14	81
Ireland	56	10	5	71
Italy	20	50	4	74
Luxembourg	31	31	23	85
Netherlands	35	29	9	73
Great Britain	32	10	14	56

Table 3. Activities of young people after compulsory school period in EEC countries 1976–1978

I underline the fact that it is difficult, because of different educational systems, to take these comparisons too far. I merely want to illustrate the fact that if we do not continue to build, develop and adapt our education service to the needs of a changing society, we are in danger of not responding to the changes that I have tried to illustrate and therefore of increasing the risk that large numbers of young people may enter a labour market in which their chances either of gainful employment or self-employment or of service to the community may be limited by a lack of relevant skills and capabilities.

Figure 2 (p 143) shows the locations of the present fourteen schemes. We have invited all the LEAs in England and Wales which wish to do so to submit proposals for an extension of the initiative, which is scheduled to start in September 1984. Therefore, by the autumn of 1984 it is likely that a significantly larger number of schools and education authorities will be taking part in the initiative. The Government has made available a further £20 million a year over five years to fund that extension.

The numbers of young people in each scheme are already known to you. Each cohort comprises about 250 young people, building up to 1,000 (Figure 3, p 144) Another of the perspectives that I wanted to mention is that even with a substantial extension of the initiative the number involved will be less than 2 per cent of each age group. It therefore remains a pilot scheme, with the involvement of a relatively small number of young people; a relatively small number of the 5,500 secondary schools in the country will be involved.

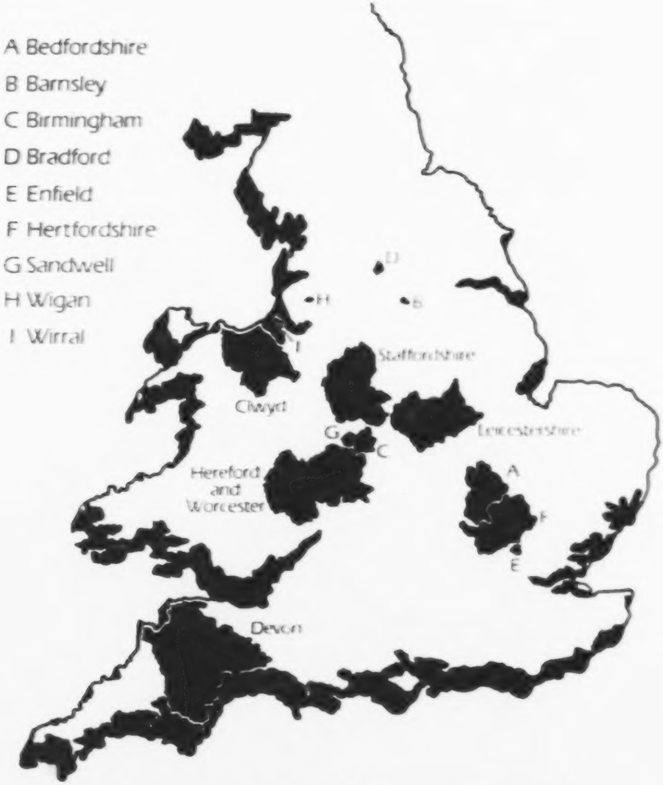

A Bedfordshire
B Barnsley
C Birmingham
D Bradford
E Enfield
F Hertfordshire
G Sandwell
H Wigan
I Wirral
D
H
B
I
Staffordshire
Clwyd
Leicestershire
G
C
Hereford and Worcester
A
F
E
Devon

Figure 2. Locations of the initial fourteen TVEI schemes.

Figure 4 (p 145) simply shows the types of institution. It underlines the importance of institutions coming together in collaborative consortia and link arrangements. One of the keynotes of this initiative has to do with the building of collaboration between institutions. Difficult though that task may often be, it is clearly important that in trying to provide a cost-effective delivery of an enriched curriculum the best possible use is made of educational resources, in schools and sixth forms and further education colleges, and in the community.

The national steering group was set up to establish the guidelines, to advise on the selection of projects, to oversee the schemes and to advise on arrangements for evaluation. The group also reports progress regularly to the Commission and to the Secretaries of State for Education, Employment and Wales. Perhaps I could remind you that the membership of the national steering group includes representatives of the education service, the TUC and the CBI, the AMA and the ACC, and assessors from the Department of Education and Science, the Department of Employment and the Welsh Office. The DES assessors include a senior representative of HMI. The national steering group has the responsibility for advising the Commission. The Commission then enters into contractual arrangements with local education authorities, and delivery is through the schools and colleges.

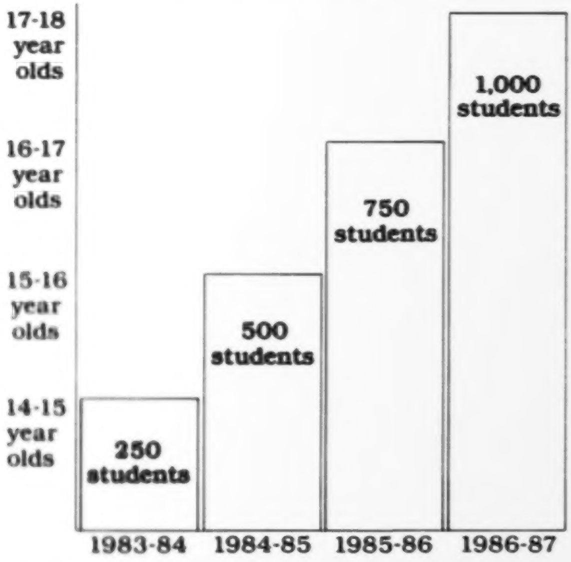


Figure 3. Numbers of students taking part in TVEI.

I will not dwell on the criteria, of which there are fifteen (Table 4, p 146). It is worth reminding ourselves that they include equal opportunities for both sexes. We have an approximately equal distribution of boys and girls on the initiative. The problem we have to face is sex stereotyping in terms of choice of subject. That is not a product of TVEI, I hasten to add, as one recent press report seemed to suggest! It has existed in our society for many centuries. We are trying to make a small contribution to a solution by providing better counselling and guidance services in schools and by encouraging boys and girls to take a wider view of the choices open to them.

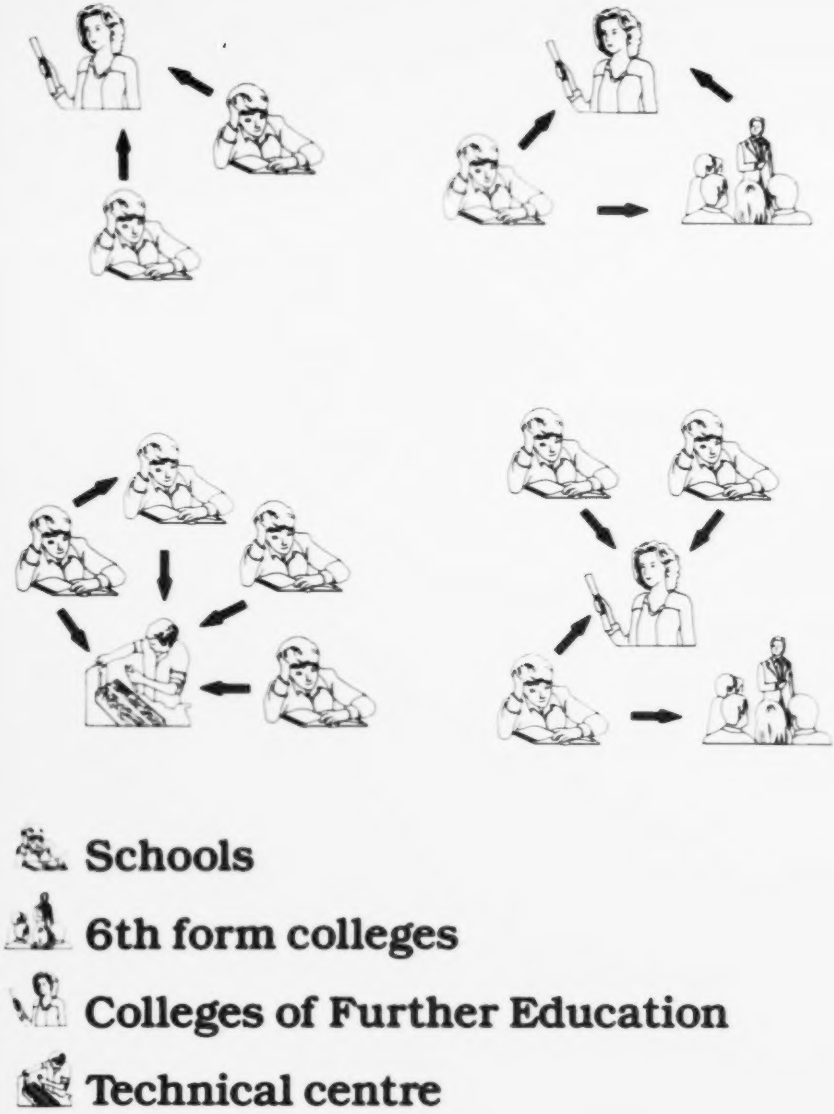

Schools
6th form colleges
Colleges of Further Education
Technical centre

Figure 4. Institutional collaboration in TVEI.

Equal opportunities for both sexes
Four-year curricula with progression from year to year
Encourage initiative, problem-solving abilities and personal development
Balance of general and technical/vocational elements throughout the programme
Regular educational and careers guidance
All students to prepare for one or more recognized qualifications
Entry open to a wide ability range
Students to take part with others in the life of the institutions
LEAs to use existing institutions in appropriate combinations
Flexibility between courses within the programme
Provision for movement in and out of the programme
Vocational elements broadly related to employment opportunities
Planned work experience from age 15 onwards
Courses linked to subsequent training and educational opportunities
Periodic assessment of progress and record of achievement on completion.

Table 4. TVEI Criteria.

I want to emphasize again that our client group consists of young people aged from 14 to 18 and that the initiative is about a four-year progressive curriculum. The development of that curriculum, as I tried to emphasize just now, must involve close collaboration not only between school and school, but also between schools and the further education service and between sixth forms and tertiary colleges. There is emphasis on the development of personal qualities. It is a requirement of the initiative that technical and vocational education must be based on a proper foundation of general education and on a proper balance in the curriculum.

I will go through the remaining criteria very quickly. There should be regular educational and careers guidance, and in some cases the provision of additional timetabled guidance and careers education. All students should prepare for at least one recognized qualification. Entry should be open to pupils across the ability range. That is very difficult to assess, because of different ways of assessing ability. We have at least a reasonable cross-section of abilities, in so far as that can be judged, in most of the current fourteen authorities. Students must take part, and continue to take part with others, in the life of the institutions. It is not the intention of the initiative to create a separate permanent group within schools. The cohort is for purposes of monitoring, research and evaluation, but it is not part of the philosophy of TVEI to create a separate category of pupils on a permanent basis within the scheme. There must be flexibility between courses and provision for movement in and out of the programme.

The vocational elements should be broadly related to employment opportunities. That does not mean that they should be linked to short-term or narrow fluctuations in the labour market and skill requirements. It means a much longer-term and broader look than that at the changing pattern of society. There should be planned work experience from the age of 15 onwards. Most important, courses should be linked to subsequent training and educational opportunities, and therefore form a coherent part of the whole pattern of professional and vocational education after eighteen. Finally, there should be a periodical assessment of progress and record of achievement.

I will conclude with that brief review. I hope that the perspectives that I have given will help to set a background against which to locate and evaluate the developments which are taking place on the ground.

11

Summing Up

Christopher Price

Recently Chairman, House of Commons Select Committee on Education, Science and the Arts

First a disclaimer. I have neither qualifications nor expertise in either science or science education. I attended the conference as a layman, with a certain amount of expertise in the politics of education; and as an observer, fascinated by the death of the secondary technical school in the 1960s and convinced that, in its demise, the English curriculum had become the poorer.

I rapidly concluded, however, that this point of view was a useful one. Neither scientists nor technologists have ever had as much influence over the curriculum as they should have had. This is not only because they have always been the politically weaker of C.P. Snow's two cultures but also because they have been politically divided against themselves, the scientists *v* the technologists, the theoretical *v* the practical. It is salutary to note that such a split has never afflicted the humanities. The humanists have always moved effortlessly into Britain's various government machines, without it occurring to them for one moment that there was some antipathy between the theory and practice of administration. If the technical schools failed, it was partly because of a fatal failure of understanding among the technologists — their protagonists — about the nature of the political process. They never lived within a clear theoretical framework; many folk, who mildly approved of them, were never quite sure *why* they were there. I remember once asking for a definition of a secondary technical school in Sheffield in the early 1960s. The best the chief education officer could manage was that a secondary technical was a secondary school which did not offer Latin A-level. Too many secondary technical schools became, through inanition on the part of those who ought to have been supporting them, far too similar to the orthodox grammar school to be credible.

This is why the title of the conference — the Rehabilitation of the Practical — became so important. The Crowther Committee was as dominated by the assumptions of its day as any other; and that is why it offered the Practical Curriculum as an *alternative*, much in the same way as the binary policy was conceived in 1965 by Mr Crosland. Both Crowther and Crosland were thinking of a by-pass to the existing, established system, in the hope that if an attractive enough one were built, more and more motorists would abandon the old traditional road through the city. Neither policy worked.

This 'alternative' mode is now being re-attempted in the shape of the Technical and Vocational Education Initiative. John Woolhouse expressed hopes that TVEI would permeate — at any rate through those schools in which TVEI had been introduced. Perhaps it may. But it won't unless a conscious effort is made to induce it to. The tradition of alternatives in the English education system is that they tend to flow in tributaries of their own and then very often die. They never seem to divert the main stream.

So, though we accepted the title of the conference — 'The Alternative Road, the Rehabilitation of the Practical' — as accurately describing our common objectives, there was unanimity that we all saw the strategy as one of permeation rather than alternatives. There was no desire to resurrect or emphasize any dichotomy between a practical and an academic curriculum in the schools. None of us wanted even to think about it in those terms.

The aim was to persuade all those within the education system to see the various schemes at present in operation which emphasized the practical — TVEI, SCIP, the SATROs and the several initiatives in microtechnology and information technology — as a cluster of influences on the whole curriculum, which could one day push it, together with its examination and credentialing mechanisms, more towards competence and capability and less towards the learning, retention and regurgitation of knowledge; and that this gradual transformation of the curriculum should not be directed to any one particular tranche of the ability range, still less to the 'bottom 40 per cent' (whatever that might mean) but to the whole ability range, including those expecting to go on to the highest reaches of higher education.

At this point I add a personal recommendation about strategy. I have always taken 'the rehabilitation of the practical' to mean exactly what it says — a return of English education to its traditional roots, rather than some new initiative based on advances in science and technology. To illustrate it, I recall the now well-authenticated story of the English 3Rs. They are assumed always to have been reading, writing and arithmetic; but we now know that this is a serious, total misunderstanding, based on a speech by an illiterate MP at the beginning of the nineteenth century. The 3Rs were always the basis of the traditional English education. But in origin they were, first, reading and writing — or literacy; second, reckoning and figuring — or numeracy; and third, wrighting and wroughting, which can be interpreted as craft or design or technology or all three according to the way you look at it. I didn't believe this story until I found an old elementary school in Devonshire, with its objectives engraved in its stone — *writing, reckoning and navigation*. The truth is that the 'practical' was displaced from the English curriculum, partly by accident and partly by the headlong rush into industrialization which seemed to make it irrelevant. Now, in the post-industrial age it should be possible to rehabilitate it.

Having tried to define 'alternative' and 'the practical' more exactly, the conference then went on to consider the tools through which a transformation of the curriculum might take place and the blockages which would prevent it. We first considered examinations, credentials, and assessment procedures. Just as we were all aware of the power of the examination system — the way in which the sheer act of measuring can become more entrenched, expensive and important than the object of that measurement — so we were also aware that if it were possible to change the nature of assessment, it might also be possible, paradoxically at first sight, to change the nature of what was actually being measured.

Though we were aware that examinations could be both a tool and an inhibition, we had no doubt about both their necessity and their importance. We felt they were necessary because of the delicate interface between the education system and the public — which included parents, government, industry and the students themselves. Assessment systems, whether or not in the form of examinations, were an essential prerequisite of public confidence; and for that reason, any process of change must not be so rapid as to lose that confidence. Though we realized that this is the perennial argument for doing nothing to change outdated examination systems, we all knew that it was a piece of reality that we had to take account of.

Then we approached the problem of cost. We were acutely aware that knowledge is often cheaper to test than skills. I have sometimes called it Price's Law of Examinable Triviality. The more irrelevant the knowledge, the cheaper it is to test, especially with computer-marked papers and multiple-choice questions. If real skills and competences are to be taught, they must be properly tested. This was another reality to be faced. My own solution has always been a CNAA for the schools, some body to guarantee to the community at large that individual schools can be trusted to do the testing for themselves. But the cost of assessment remains and must be faced.

So having looked at the blockages, we came down to the assessment tools which we preferred. Here we did not find total unanimity. My formulation was that we wanted to move to something very much nearer profiles — which might contain the results of different clusters of graded tests — and something very much further away from present orthodox GCE methods of assessment. Others, more accustomed to university examinations, talked of a philosophy of assessment closer to engineering science syllabuses and further away from physics ones. We all agreed that we wanted a system of assessment where the student *did* more and *wrote* less; and that in all these systems, there had to be some sort of dialogue at some stage between the student examinee and the teacher/examiner.

So we reached a degree of consensus: but I do not deceive myself that the present character of our school examination system and the determination of powerful elements in Parliament, government and industry virtually to equate that system with high 'standards' in education constitute at the moment the most powerful inhibition to the 'rehabilitation of the practical' in schools. The story the conference heard from Scotland, where the combination of the Munn and Dunning reports is already introducing a quite new flexibility — particularly in science and technology — into the school curriculum, indicates what could be done in England to make 'the practical' a more accepted part of the curriculum. It has to be said, however, that with the replacement of the Schools Council by new examination and curriculum councils with no noticeable connection between them, there is little hope on the English horizon that such flexibility or even encouragement will be forthcoming from above. The pressure will have to come from below; and though there are many teachers and others active in the examination boards who would welcome it, there are also many teachers who wouldn't. There never has been a climate in the English school system less amenable to change of this kind. Morale is low; for most teachers, there is little incentive to do other than pursue the traditional curriculum with which they are familiar.

It was this truth which drove the conference to consider next the possibility of intervention at local or at least sub-regional level. Everyone recognized that the age of policy direction coupled with resource provision from the centre was over in the *schools*. It was true that this was now the *modus operandi* of the Manpower Services Commission, and the TVEI programme in the schools was clearly crucial. But any change in the shape of the school curriculum was more likely to come from individual schools or local authorities taking informed, deliberate initiatives than it was through pressure from above. But it is one thing to come to that sort of conclusion; quite another to decide how initiatives can be generated in the present financial climate.

As far as local education authorities are concerned, expenditure is to be strictly controlled — on the basis of existing or reduced provision — for the first time in the history of local government. Once again, it is the worst possible financial and economic environment in which to be talking about changing the curriculum — especially in a way which may cost substantially more to deliver.

Or it would be, if it were not for TVEI. The history of TVEI is one of the most bizarre educational initiatives ever. It seems that the Prime Minister, over the head of the Department of Education and Sir Keith Joseph, simply instructed David Young, the Head of the Manpower Services Commission, to start up a scheme, in selected local authorities, which would involve 14 to 18 year-olds who would not be expecting to go on to O- and A-level GCE. The initial scheme is so generously funded that it involves investing four or five times over the average in two years of the education of a mere 10,000 children; and it seems very difficult to imagine how it will ever be extended to all the youngsters in the schools who want it. The idea was acceptable to most of those in the conference as one means to transform the secondary curriculum. Reservations centred round whether the curriculum was to be transformed for only a minority of low achieving children in some areas; and whether the attempt to carry it out very quickly through a funding agency outside the education service would cause more problems than it solved.

On the second point the conference was reassured by Richard Knight, the

Chief Education Officer for Bradford. The local authority was in control, and the project was going ahead smoothly. It was too early to answer the first question, since the answer depended very much on the philosophy of 'permeation' I have discussed earlier. John Woolhouse told us that, although TVEI was intended specifically for a particular target group of youngsters, he hoped that the ideas — particularly the emphasis on the practical and new methods of assessment — would permeate the school where it was established, and perhaps other parts of the local authority as well. If this philosophy of permeation works, then we may see some changes. It will be a shock to the system, since the MSC involves specific grants to schools, greater control of the curriculum and far less consultation than the education service is used to. Many of these techniques could bring dangers and chaos. But in terms of the rehabilitation of the practical, it has positive features. If they do permeate the system, good will have been done.

One of the difficulties, however, of setting up MSC intervention as a pattern for change in the future, is that although its tools and techniques are a valuable antidote to much that goes on in the traditional curriculum, its objectives are fundamentally out of date. The MSC's role is to train people for *employment*, and rely in particular on *industry* (whatever that might mean) to dictate the nature of that training. Almost as soon as the objectives of the MSC were formed, they became out of date. They are based on an assumption of full employment, and a fairly hierarchically stratified full employment at that; the conference was agreed that we would have to make the transition from a curriculum preparing for work skills to one preparing for life skills. Increasingly words like 'employment' would go, work or lifestyles would reappear in their place; words like 'industry' would be replaced by others connoting all activity which goes on in the community. The French expression *la vie professionelle* we all found a better way to describe the different sort of futures awaiting the graduates from our schools. Once again, though there is evidence that some workers within the MSC would like to change their role in this way, there was no evidence at all that the government was going to allow the MSC to do so officially. So the constraints of the type of curriculum encouraged by the MSC in the schools were likely to remain in force. The training would always be in danger of taking on a mechanistic air; and the hopes that it might permeate through the whole school could be correspondingly frustrated.

The final two substantive issues we considered were resources and training. We recognized the dangers of the present MSC pattern of distribution — comparatively generous provision in a small number of centres and nothing elsewhere. It echoed the independent school examples held up to us — at Sevenoaks and Dauntsey's — where comparatively rich resources made possible a number of breakthroughs within an extremely traditional public school curriculum. It was clear that if the curriculum is to change and more skills are to be taught in school, very many more resources will have to be provided; and there was no evidence of any intention on the part of central government or capability on the part of local government to provide these resources. This was not to say that we saw resources solely in terms of grants raised from money provided by the taxpayer. We heard that Bradford, through the TVEI, was beginning to tap unused resources in the community and hoped to do more. It was important to get away from a narrow fiscal view of resources for change in the curriculum; people, often unemployed people, should also be regarded as a community resource. But when all that was said, we all agreed there were not nearly enough resources at the moment to begin significant change in the curriculum towards the 'rehabilitation of the practical' across the board. Whatever did happen, would happen in a localized and comparatively isolated context.

Then the conference considered training, and in particular retraining. We were aware that other curricular innovations had been frustrated in the past and the whole system had reverted to the norm for the lack of this one essential element. This also involved resources; but even more it required the cooperation of employers and others in the community. The task was nothing less than the retraining of tens of thousands of teachers towards a different way of looking at their subject; it was a daunting task but no curriculum change could become permanent and entrenched without it.

These then were the tools we felt would be needed, if we were to begin the task of transforming the curriculum from one which involved learning facts to one of using skills. The paradox was that there was at the moment a very wide spectrum of opinion within the education world and even more outside it favouring reform along these lines. Yet nothing ever seemed to happen; in spite of a proliferation of projects and experiments, the English curriculum remains frozen in a fossilized mass. We all felt the longer-term answer to this was *dissemination*: stories of where the practical curriculum was working particularly well, arguments to the community, arguments to industry, a campaigning spirit. If this was an idea whose time had come (which I firmly believe) its protagonists should be singing its praises and working for change. Indeed some of the best ambassadors of the practical curriculum would be the students themselves, not just singing its praises but also conveying some of the elation which taking practical control over one's immediate environment can bring. If there were to be a further conscious push for the re-establishment of a practical element for all within the system, much of the effort would have to be put into telling the world what it was all about and why it was necessary, and into getting the support of the community, of industry and above all of the universities and polytechnics, which, if they strove to stick to orthodox assessment, could strangle the movement at birth.

Nevertheless, I have no doubt that the rehabilitation of a practical curriculum in English schools is a battle worth fighting, even in the present unpromising climate. First because it really is an authentic reversion to a better approach towards real education rather than nineteenth- and twentieth-century credentialing. Second because those fighting for it will not be alone; there are many groups in the country — the Royal Society of Arts, the Standing

Conference for Schools Science and Technology, the Manifesto for Change group — who have exactly the same objectives; and simultaneously there is a growing number of teachers who are deeply dissatisfied with the educational diet offered in schools at the moment. If a coordinated programme of ministerial action, academic research and change in individual schools went ahead, a new curriculum and new assessment and examination procedures could spring up quite quickly, which would enable a new generation to cope with the new century in which change will be even more rapid than it is today.

Participants

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